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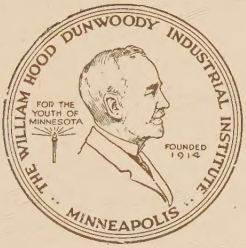
Tire Repairing and Vulcanizing

PREPARED BY
HENRY H. TUFFORD



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INTRODUCTION

Tire repairing has rapidly come to the front as an important part of the automobile industry. The available books on the subject, however, have not filled the demands. The need for a clear cut and yet complete book, taking up all the phases of tire repairing, has been before us, and this need was clearly brought out when the training of U. S. Army men was started in Minneapolis by the Minneapolis Tire Dealers Association and Dunwoody Institute. This book has been developed to help fill this need. It treats the various problems which come before the tire repairman and gives him the best practice on the different repair jobs. It is not only valuable to the beginner but to the experienced tire repairman as well. The chapters on cord tire repairs and cost data will be particularly interesting to the high grade repairman or the shop owner. The man just starting up a business will be interested in the shop equipment chapter. A generous number of cuts explain in detail the tools and the operations.

The material contained in this book represents only the most approved methods of tire repairing. Methods formerly used but now out of date have been eliminated.

The author is indebted to the various tire manufacturers for the use of illustrations, and to the Minneapolis Tire Dealers Association, which has given valuable assistance in the development of this work.

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CHAPTER I.

RUBBER AND COTTON.

There are many different kinds and qualities of rubber, but the one most in use and of the best quality is that known as up-river Para, a gum containing only from 2% to 4% of resins, and which when washed in the factory loses only from 15% to 20% of its weight. This rubber originally was found in the upper Amazon regions and in the Brazilian plateaus, but since its desirable qualities have been discovered planters in other countries such as Ceylon and the Malay Peninsula have been making a specialty of planting these trees. Most of the rubber was formerly gathered from trees which grew wild, but now most of the rubber comes from cultivated rubber plantations. The hevea trees can be tapped at the age of four years, altho other varieties will bear earlier. Contrary to general belief, the latex, as this fluid is called, is not the sap of the rubber tree, but a fluid found in the bark and edges of the trunk. Thus when the tree is tapped it is only the bark that is cut.

There are three common ways of tapping a tree, the herringbone, the half herringbone, and the basal. The latex is gathered and taken to coagulating rooms, for when first gathered it is a milky white fluid, which hardens quickly. In the uncultivated regions the natives will dip a stick in the fluid or latex and by holding it over a fire built of certain palms, dry and smoke it at the same time, adding layer after layer until it is in the form of a large ball. The planters, however, must do otherwise, as their output is too large to be handled in this way, so they first pour the latex into shallow pans adding a certain part of acetic acid to hasten coagulation. Then when sufficiently hard it is taken to the drying room and there allowed to dry until all moisture has gone, which may require several weeks. The sheet is finally taken to a large smoke-filled room. The rubber is smoked, as this not only keeps it from becoming mouldy but improves the quality; nevertheless, it is sometimes sent to the factory in a crude, unwashed state. As a rule rubber usually arrives fom the plantation in the following forms: loaves, biscuits, crepe sheet, and crude. Upon arriv-

ing at the factory rubber must be washed unless it should happen to come in smoked sheets which are, as a rule, clean.

WASHING: Rubber washing machines consist of two grooved rollers working opposite each other, one roll being larger and revolving at a greater speed than the other, the idea being to tear the rubber down and remove the impurities. A stream of water is constantly flowing over it to wash away the dirt, etc., as fast as relieved and also to keep the rollers from getting hot from the friction of the rubber as it goes through the mill. The rubber is first cut into small pieces and soaked in warm water to soften the hard crust which forms. From the washing mills it is taken to a pair of smooth rollers and pressed into thin sheets so that it will dry quickly, which at best usually requires several weeks. The sheets are usually hung in a room of constant temperature, heated by a stream of heated air. There are several other methods of drying, but the one above is the one mostly used.

MASTICATION: The object of this operation is to knead the rubber as it comes from the drying rooms until it is soft enough to allow the introduction of various compounds used in vulcanizing. The mills are almost the same as the washing mills, except that the rolls are hollow to allow steam to pass thru to warm them. Cold water can be forced in should the friction caused by the rubber on the rolls make the rubber sticky. From here the rubber goes to the mixing mills. We will state here that the rubber in this state is called pure gum; from which cements and cushion stocks are made with a small amount of compounding. This gum is next put thru the mixing mills.

MIXING MILLS: These are rolls about the same as described before, except that there is a tray under them to catch the compounds that do not imbed in the rubber at once. The operator starts and adjusts the roll so that the sheet of rubber is just too thick to go between the two rolls and, as a result, the rubber masses itself at the junction of the rolls. Into this space the operator dusts his compound materials and these are gradually worked into the rubber. After it has been sufficiently compounded, a strip is cut off and taken to the testing room where it is cured and tested for the various qualities desired in the compound.

CALENDERING: This is done in a large rolling mill with three rolls which are steam heated and are adjustable for any thickness of rubber desired. The calender is used first for pressing the rubber into sheets of the desired thickness, with an attachment for

cutting same into strips of different widths. It is also used for frictioning the fabric by forcing the rubber thru the meshes of the cloth.

This describes in a general way the manipulation the rubber goes thru in preparing it for use.

COMPOUNDS.

As rubber is not a substance that will stand wear or abuse, it, therefore, must be compounded. All rubber companies making tires and repair stocks have their own compounds of different wearing qualities and colors, which are unknown to the general public; however, the following is a list of materials commonly used in compounding:

ALUMINUM FLAKE: An inert heat resistant which toughens the rubber.

ASBESTOS: Low conductivity of heat makes it valuable in steam packings. Useful in fireproof materials.

ASPHALTUM: Softens compound, retards blooming, limits oxidation, and increases density.

ATMIDO: Snow white filler, low specific gravity, indifferent to acids, used in small portions to increase strength and resiliency in soft rubber goods. Also used in large portions to make hard compounds and to resist super-heated steam.

BARYTES: Heavy, white material, inert, which increases resistency and adds weight.

BLUE LEAD: Cheap filler, produces black color; heavy, and often displaces barytes.

BURNT UMBER: Dark brown, inert, good filler, often used in brown and maroon goods.

CARBONATE OF CALCIUM: Whitening, used only as a filler.

CHARCOAL: Made from bones, absorbes odors and is used in packing to withstand heat.

CHARCOAL: Vegetable or burnt wood, is used in certain vulcanite and insulated wire compounds.

CORK: Used in kamptulican,, in rubber as binding material; at one time used with rubber to make it waterproof; also used to resist heat.

EMERY: Used in manufacture of vulcanite wheels.

FIRE CLAY: Mixed with rubber and dissolved in tar, oil and

sulphur, forms a compound, which when applied to hot joints cures at once.

FRENCH TALC: Ground and sifted talc for tire lubricant.

LIME (air slacked): Used in small quanities to increase hardness and decrease curing time.

LITHARGE: A lead compound with specific gravity .9935. It is valuable as a filler and also hastens curing to a marked degree.

MAGNESIA: Increases toughness and resilience and is also used to increase hardness.

MAGANESE: Used in cements.

OIL: Castor, linseed and rape oils used as a filler.

PLUMBAGO: Sometimes called black lead, more non-combustible than most ingredients, and therefore, used in rubber compounding to make articles capable of withstanding great heat. Inert.

POWDERED COAL: Cheapest for making jet black semi-hard rubber.

RUBBER WASTE: Used as a filler, when reclaimed.

SOAPSTONE: Used in place of talcs to keep rubber surfaces from sticking and as an adulterant.

SULPHUR: Without which rubber could not be vulcanized. There is from 3% to 7% of sulphur in tread gum compounding.

TALC: Used in preventing rubber surfaces from sticking together during manipulation or vulcanization. It is also used for dusting moulds to prevent gum from sticking to metal. It is sometimes used as a compound.

WHITING: Made from English chalk, used more extensively than any other compound except sulphur. Increases resiliency and hardness.

There are altogether about 200 different compounding materials and the following are some of the less known: Aluminite, zinc, odide, white lead, China clay, fossil flour, asphalt, camphor, clay chalk, earth of various kinds, gelatine graphite, leather waste, lime, paraffine, pitch pumice, sawdust, shellac, sand, slate, starch, tar, varnish, wheat flour.

COTTON FABRIC.

The most commonly used fabrics are made from the following cottons: Long, white sea island cotton which is a white, long fibre of high tensile strength. Egyptian cotton which is a short, dark

fibre of less strength than the long, white, sea island cotton, and domestic cotton which is a short, white fibre of weaker strength than the former cottons. The cheaper grades of tires are made from domestic and Egyptian cotton and better grades are made of combinations of long, white, sea island cotton. These mixtures of cotton are woven at the mills into fabrics of different weights and then taken to the tire factory for frictioning and coating with the rubber gums as is required for the various uses in making tires or for repairing them. All of the gums are frictioned or coated to the fabric under pressure on the calender in the factory and are cut in rolls or strips ready for the use they are put up for.

CHAPTER II.

REPAIR FABRICS, GUMS AND CEMENTS.

GUMS: There are many gums used in the repair trade, which vary according to the amount of compounds added for the purpose of obtaining wearing qualities in the rubber. Gums of low specific gravity have a very small amount of compound. In this class we have cushion gums, tube gums, and cement stock. As the specific gravity increases we have more compound to withstand more wear and friction. This will be found in the tread and side wall gums.

CUSHION GUMS: These are of low specific gravity, being slightly compounded, therefore, they have more resiliency and adhesive quality than the high specific gravity gum. They are used throughout the tire as a binder between the fabrics and between the tread gums and the carcass of the tire, absorbing the shocks and concussion of the tire and protecting the carcass. The average thickness used in repair work is 1-32-inch on fabric tires and 1-64-inch on silvertown cord tires. These thicknesses will do for any and all practical work. Cushion gums are of the long cure variety.

TUBE GUMS: Tube repair gums are of a slightly higher specific gravity than cushion stocks, as they must withstand more friction and heat. They are of a short cure variety. Tube gums are furnished in two varieties, for inside and outside work. The inside gum or combination, as it is called, consists of a layer of raw tube gum attached to a thin layer of semi-cured gum, the thickness being about 1-32. This combination gum is used on the inside of the tube, only, for backing up a hole in the tube. The filler gum or raw tube gum can be ordered in any thickness; 1-32-inch, however, is preferred for outside repairs on the tube.

TREAD GUM: Tread and side wall gums are of the same specific gravity approximately and are very heavily compounded to withstand wear and friction. These gums can not be used for any other purpose than what their name implies, namely that of application on the wearing surface of a tire. The color is optional to the

tire manufacturer and is determined by the compounds or chemicals that he uses in his gums.

For this reason the up-to-date repairman will order his gums from the individual manufacturer to match all colors of gums, providing the company makes repair gums.

Tread and side wall gums are used mostly in 1-16-inch thickness, although in cases of retreading, a thicker gum is used.

CEMENTS: Factories have different formulas for making cements, some of which contain chemicals. Very low specific gravity gums, however, are the basis of making cements, more paticularly vulcanizing cements. Gums of this nature dissolve or cut with high grade gasoline or benzol in quanities of 1 pound of gum to the gallon of gasoline, or otherwise with an addition of 4 ounces of wood alcohol, will make a good shop cement for all vulcanizing purposes. This mixture should be stirred continually until cut. The alcohol merely hastens the cutting of the gum, although cement can be made without alcohol. All cushion gums and fabric scraps will make good cements as these are low specific gravity gums.

Air drying or patching cements and acid cure cements can be secured at any time commercially and, being used in small quantities for such work as tube repairs, do not require mention at this time.

FABRICS: Fabrics are based in the tire repair trade on thickness of the fabric and the coating or frictioning on the surface. A fabric may be frictioned on one side, in which case we call it bareback. This bareback is used as the last ply of the inside repair. A fabric may be frictioned on two sides in which case it would be used in a light weight fabric for a bead cover. The fabric may be frictioned two sides and coated one, in which case it is used mostly for the building up of a tire either as a new tire or for repair work. Some fabrics are frictioned two sides and coated two sides, but usually from coarse, open, woven fabric which is used for a breaker strip in the tire.

The terms friction and coated mean that gum of a low specific gravity is forced into the fabric by the calender rolls in the factory. When it is frictioned the gum is pressed on very lightly and even with the cotton strands of the fabric, while coating implies that more gum is used and that it completely covers the fabric to a depth of about 1-64 of an inch. It is not necessary for building fabric to be coated on two sides, due to the fact that the two coats of gum would take up too much space between the plies and not deliver the strength.

CORD FABRICS: A new fabric has come into prominence lately

which is used in the manufacture and repair of cord fabric tires. This cord fabric is made from long fibre cotton which is twisted in cords of small diameter and held in place by cross threads when it is frictioned and coated. The cord fabric tire is built in plies like the fabric tire.

Silvertown Cords: The carcass of the Goodrich silvertown cord tire is made of heavy cable cords in two plies. This cord, like the cord fabric, is twisted together into very large cable cords and takes the place of the fabric or cord fabric in the construction of the tire.

Care of Repair Stocks:

1. Always keep your stocks in a medium dry place.
2. Keep all stocks covered from dust, etc.
3. As soon as received hang your stock up on rolls.
4. Never lay stock down or place on end.
5. If gums stick to cloth or holland, wet with benzine on opposite side.

Cutting of Repair Stock:

1. Cut all bareback and fabrics on the bias, except breaker.
2. Cut your breaker straight, and bead fabric in bead repairs. straight.
3. Always trim the selvage on bareback and fabrics.
4. Cut your gums with the grain.
5. Always lap fabrics one inch when connecting.
6. Butt bareback and strip with cushion when connecting.
7. Always wash bloom, dirt, etc., from gums and fabrics before using with gasoline.

SCALES FOR CUTTING FABRICS AND GUMS.

Size	Width of Fabrics for Sectionals Repairs		Width of Cushion Gum ($\frac{1}{32}$")	Width of Breaker Fabric	Width of Side Wall Gum ($\frac{1}{16}$")
	Inside	Outside			
3 in.	9 in.	10 in.	3½ in.	2¼ in.	1¼ in.
3½ in.	10 in.	12 in.	3½ in.	2½ in.	2¼ in.
4 in.	10 in.	12 in.	4½ in.	3 in.	2½ in.
4½ in.	12 in.	14 in.	4½ in.	3¼ in.	2¾ in.
5 in.	12 in.	14 in.	5 in.	3½ in.	2¾ in.
5½ in.	12 in.	16 in.	5½ in.	3¾ in.	3 in.

On 3½ and 4-inch use size smaller for first ply on. This applies to all sizes. Practice will enable a repair-man to cut his fabrics one inch less in width.

SCALE FOR RETREAD WIDTHS.

Size.	Ply towards the Fabric.	2nd Ply.	3rd Ply.	4th Ply.	5th Ply.	Last Ply.	Total Ply	
3 in.	2¾ in.	3½ in.	.....	.....	.....	Optional	3	For width
3½ in.	2¾ in.	3½ in.	4¼ in.	.....	.....	after	4	of
4 in.	3¼ in.	4 in.	4¾ in.	.....	.....	Buffing	4	Breaker
4½ in.	4 in.	4¾ in.	5½ in.	.....	.....	and	4	see scale
5 in.	4¼ in.	5 in.	5¾ in.	6½ in.	.....	Cementing	5	above
5½ in.	4¾ in.	5½ in.	6¼ in.	7 in.	7¾ in.		6	

THICKNESS OF GUMS AND KINDS OF FABRICS.

Material.	Thickness.	Description.
Tread Gum	1/16	Color optional, compounded for wear.
Side Wall Gum	1/16	Color optional, compounded for wear.
Cushion Gum	1/32	Color optional, low specific gravity.
Tube Gums, Filler	1/32	Color optional, medium specific gravity.
Tube Gum Combination	1/16	Color optional, one semi-cure side.
Fabric	F2 C1	Color optional, for sectional work.
Fabric, Bead	F2	Color optional, bead covers.
Fabric, Bareback	F1 C0	Color optional, inside reinforcing.
Fabric, Breaker	F2 C2	Color optional, breaker strip.
Reliners	....	Color optional, complete reinforcement.
Cements	....	Color optional, any good vulcanizing cement.
Cord Tread Gum, No. 8100	1/16	Black, Goodrich Silvertown.
Cord Tread Gum, No. 677	3/32	Black, Goodrich Silvertown.
Cord Side Wall, No. 8200	1/16	Grey, Goodrich Silvertown.
Cord Cushion, No. 8300	1/64	Black, retreads and sectional work.
Cords, any size	....	
Bands, plain ribbed and non-skid	....	
Staples, No. 2 and No. 4	....	
Cord Fabric, No. 7430 only kind on market at this time	....	

Firestone Cord Tires can be repaired with Firestone Cord Fabric.

CHAPTER III.

PNEUMATIC TIRE AND RIMS.

Many types of pneumatic tires are on the market; however, these can be placed in two classes, namely, fabric tires and cord tires. There is a considerable difference between the carcass construction of the two types, which we will take up later. The completed tire of either type is used for the same purpose.

Bead Types: All pneumatic tires are built for individual use in three types of beads, which are as follows: Regular soft bead clincher, quick detachable clincher, or hard bead clincher, and the regular straight side bead. The regular clincher bead is made up of a soft expansible core for the purpose of stretching or forcing the bead of the tire over a solid rim so that it will slip into the indention of the rim and hold there when the air is put into the tire. The Q. D. clincher bead is composed of a hard rubber core and in many cases is reinforced with a steel wire or cable, which prevents stretching of the bead. For this reason one side of the rim must be loose or detachable in order to slip the tire on the rim, after which the detachable ring or side is placed and fastened according to different methods. The bead indention of the Q. D. clincher is the same as the regular clincher, except for the removable side or ring. The straight side bead is, as it implies, straight, and fits a rim without any indention, the bead core itself being somewhat similar to the Q. D. core, or made up of a hard rubber core with cable reinforcement.

Tire Sizes: The present pneumatic tire is made in standard sizes of an air capacity sufficient for its intended use on cars or trucks of a certain weight. In all cases a tire may be constructed to fit the same rim and have a larger air capacity for carrying a greater load, in which case we have the oversize. The oversize tire is constructed for the purpose of holding more air, as we have said, and usually is made larger and with additional fabric or cords, as the case may be. In order to designate the oversize or regular size of a tire it should be known that the measurements cover the complete diameter of the tire from the outside point of tread, and the height of the cross section

of the tire from the top tread to the bead. For example a 34x4 tire means that it is 34 inches across the complete tire to the outside tread or surface and that it is 4 inches from the bead to the top of the tire on the cross section. Should you deduct the depth of the two cross sections, which are 8 inches in this case, from the complete diameter of the tire you would have the rim size, or in this case a 26-inch rim or wheel. An oversize for this tire would be figured by adding 1-2-inch to each cross section on the outside of the tire to take care of the additional fabric and air space. This would make the cross section 4 1-2 inches. You have added 1-2-inch on each, or 1 inch to your complete diameter which would make your complete diameter 35 inches, or your oversize a 35x4 1-2, and you have not changed the size of your wheel or rim, for by taking 9 inches from 35 inches you still have 26 inches for your rim or bead size.

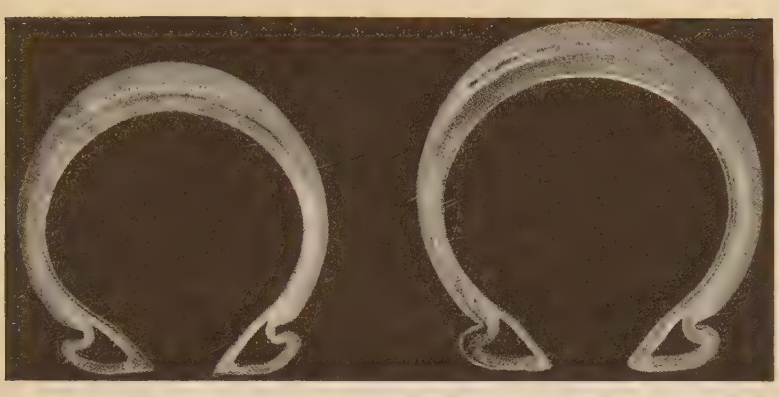
PNEUMATIC REGULAR SIZES AND OVERSIZES.

Regular Size	Over Size	Regular Size	Over Size
28 x 3	29 x 3½	34 x 4½	35 x 4½
30 x 3	31 x 3½	36 x 4	37 x 4½
32 x 3	33 x 3½	32 x 4½	33 x 5
30 x 3½	31 x 4	34 x 4½	35 x 5
32 x 3½	33 x 4	36 x 4½	37 x 5
32 x 4	33 x 4½	36 x 5	37 x 5½

The standard pneumatic as listed above is sometimes used or ordered in metric sizes to conform with foreign cars and the following comparisons or regular sizes and metric sizes are approximate although not exact.

METRIC SIZES.

Standard	Metric	Standard	Metric
26 x 2½	650 x 65	33 x 3½	840 x 90
28 x 2½	700 x 65	34 x 3½	870 x 90
30 x 3½	750 x 65	36 x 3½	910 x 90
32 x 3½	800 x 65	38 x 3½	960 x 90
33 x 2½	830 x 65	40 x 3½	1010 x 90
34 x 2½	860 x 65	32 x 4	815 x 105
28 x 3¼	700 x 85	34 x 4	875 x 105
30 x 3¼	750 x 85	36 x 4	915 x 105
32 x 3¼	800 x 85	32 x 4½–5	820 x 120
34 x 3¼	860 x 85	33 x 4½–5	850 x 120
30 x 3½	760 x 90	34 x 4½–5	880 x 120
32 x 3½	810 x 90	36 x 4½–5	920 x 120



COMPARISON OF THE REGULAR AND OVERSIZE TIRE.

CONSTRUCTION OF TIRES.

Fabric Tires: It is essential for the repairman to know the construction of a tire from the sectional end view; when this has been mastered the repairman can make rapid headway in making a decision of the kind of repair he will make. By referring to the drawing below a sectional end view of a fabric tire of the 4-inch size is shown. Almost all tires are built on this principle, with the exception of the silvertown cord types, with more or less plies of fabric and the required bead.

The tread or outside covering for direct running is made to stand wear and friction. The side wall is made of the same gums as the tread. The tread and side wall gums constitute the covering of the tire and are more for protecting and giving wearing qualities to the tire. They do not have any great strength, as far as resisting the air pressure is concened.

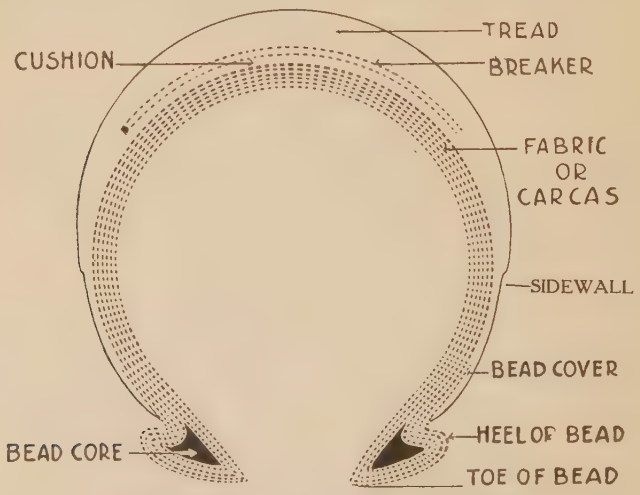
The breaker strip is a loose woven fabric of heavy cotton and is placed under the tread, over the cushion. This breaker is used for the purpose of taking up the concussion and shocks on the outside of the tire and distributes it evenly over the carcass of the tire through the cushion. The breaker acts as a binder for the carcass by stiffening the cushion and tread gum.

The cushion is usually placed under the breaker. It is a cushion or pad to the carcass and on account of the great adhesiveness of the gum makes a better uniting factor for the tread and eliminates shocks to the carcass, acting with the breaker.

The carcass of the tire is the real strength of the tire and is composed of layers of fabric and cushion gum built over a core to shape the tire and size at the ends of which is placed the beads. You will note that the fabric is usually split about one-half, in layers to come around the bead on the outside and inside and in most cases ends at the toe of the bead, which is the part nearest the tube. There are some exceptions in this, especially in cord fabric tires and in Dunlop styles. In the Dunlop style there is one ply which is built from the inside of the tire and outside up the side wall about 1 to 1 1-2-inch, which must be taken into consideration in repairing these tires, as it is the binder of the bead and cable in this type. As tires increase in size the number of plies increase and in making a repair it is essential to remove plies sufficient to eliminate the injury.

The bead of the tire may be, as mentioned before, soft rubber, or hard rubber with cable for holding the circle. There are two distinct parts to the bead, the heel and the toe. The toe is nearest to the tube.

The bead cover is a thin fabric which in most tires is run from the toe of the bead up over the heel and in some cases up the side wall. In some tires it continues inside of the tire. Some manufactures of tires do not use a bead cover, so it is important to know your tire to the extent of removing a bead cover or providing for it.



DRAWING OF FABRIC TIRE. REAR VIEW.

Cord Fabric Tires: In recent years the cord fabric tire has come into prominence as a competitive tire, and many manufactures

have a cord tire or, to be more definite, a cord fabric tire. The cord fabric tire has been sold for many years under another head, such as special tires for heavy electric cars. However, it is now much in demand for all makes of cars as a cord tire.

The cord fabric is built almost similar to the regular fabric tire, the cord fabric being built up on the core and the same system of beads being used. It is much stronger than the fabric tire and will be found, in the lager sizes, to be immune to heat and friction to a greater degree than fabric tires, as the cords are completely imbeded in the gum. On the fabric tube the outside only is coated or pressed into the fabric, leaving dry spots at the thread intersection.

The methods of repairing cord fabric tires will be found under the detailed explanations.

Cord Tires or Cable Cords: The cable cord tire has a destinction of having an entirely different method of construction from the fabric or cord fabric tire, due to the fact that it is made from very heavy cords arranged in two to three layers only and has different bead construction for holding the cords. The cable cord tire, like the cord fabric tire, is less liable to heat, due to the imbedding of the cords, or strands the cords are composed of, in the gum so that each strand is connected with the gum. More tensile strength is obtained and the tire is more elastic, taking less air, as the cords will not break as quickly as the fabric when the circle is decreased.

Under the cord method of repairing will be found the various bead constructions of the cable cord tire.

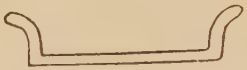
Rims: The repairman will have very little to learn of rims, providing he has a knowledge of the types in use. There are many makes, and new ones are coming on the market all the time, but when it is all summed up, there will be four types found in the different makes.

The clincher, which takes a soft bead tire only, and is endless, usually being a part of the wheel, although in some cases demountables are provided.

Clincher or Q. D. Type. The clincher rim being endless. The Q. D. Rim split or with Detachable side.

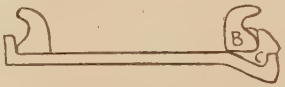
The Q. D. clincher, which takes only a solid bead Q. D. tire, and one side being removable.

The straight side rim, which takes a solid bead S. S. tire with one side removable.



Regular S. S.

The universal rim, which has interchangeable sides for taking both straight side and Q. D. tires.



Universal used for S. S. and Q. D.

The methods of changing tires from the rims are optional with the repair man and many devices are on the market for the quick removal of tires from the rim. The writer has found, however, that with a machinist's hammer, two 10-inch screw drivers and a pair of pliers, any tire can be removed as quickly, when taking all rims into consideration, as by using special devices for the work.

CHAPTER IV.

TIRE INJURIES, REPAIRS AND ADJUSTMENTS.

KINDS OF REPAIRS.

It is essential for the repairman to immediately arrive at the cause of a defect or injury and determine if the tire can be repaired and if so, what kind of a repair it should take, or if the tire should be returned to the manufacturer for adjustment. The repairman must remember that he is in the repair business and must use judgment in making a repair. Tires beyond repair should not be repaired under any consideration, merely to take the customer's money. Make your decision on the merit or condition of the tire, and be sure that you can deliver the same proposition of mileage as if the customer bought a new tire. If, however, in your judgment you think the tire is defective, tell your customer so, and adjust or send it in for him. After looking over a tire and you have found that it was put out of service through abuse or injury, you should determine what kind of a repair it will take, which will be found under the following:

RETREAD: To place a complete new covering or tread on the tire after the treaed has become loose or worn off and the carcass of the tire is in good shape.

Cord tires (cable) can ordinarily be retreaded in most cases and it will pay the customer to do it. On fabric tires, however, any separation of the fabric would eliminate retreading.

RELINER: Which can be purchased from any manufacturer and is used for cementing inside of a tire that has been run flat, underinflated or overloaded, or might be full of nail holes.

COMPLETE SECTION: A repair to blow-out cut, break or otherwise, in which you cut out the old fabric and eliminate the injury and friction, same being built up new.

SIDE SECTION: Same as a complete section only that one side wall is left on the tire. The side section is used on short rim cuts and holes on the side of the tire.

TREAD SECTION: In which you replace a part of the tread which has been torn out.

TREAD PATCH: Usually a small spot about 4 inches, on a tire that requires new gum to keep out water, dirt, etc.

REINFORCEMENT: A fabric covering over nail holes or back of section on the inside of a tire.

BEAD SECTION: The replacing of a rubber section of the bead, which might be broken by a tire jumping the rim. Tires with broken cables in the bead.

CORD SECTION: Usually applies to replacing cords, inner or outer in a cable cord tire.

BEAD COVER: The replacing of a new cover over the bead on cord fabric or cable cord tires.

PUNCTURE PATCH: A special reinforcement for a nail hole in a cable cord tire.

NEW STAPLES: Replacing same in a Goodrich silvertown cord Q. D. tire.

INJURIES AND DEFECTS.

When making an inspection of the tire the repairman should remember that should a tire show a defect, an adjustment is due the customer on the unrun mileage of the tire, providing it is put out of service through the defect. A tire showing a defect and still serviceable, in many cases will not be accepted for adjustment as the tire may out-run the defect. No tire is guaranteed to run a mile, the guarantee being that a certain mileage will be considered a basis of figuring the adjustment, providing it was put out of service on account of a defect under the mileage guarantee.

Any abuse or injury to a tire, knowingly or unknowingly, will eliminate a claim for adjustment, and any injuries as listed below will be considered as work of the repairman, and not due to any consideration from the factory.

BROKEN SIDE WALLS: Usually caused by under inflation, run flat or overloaded, or running in car tracks.

LOOSE TREADS: Under inflation, overloading, running flat, chain abuse, or caused by fillers like reliner. Adjustment possible.

WORN TREADS: Wheel out of alignment, quick breaking, etc., or chains.

CUT TREADS: Caused by fender bolt injury or glass, etc.

CREASED TREADS: Caused by running in car tracks.

RUT WEAR: Wearing sides off by running in ruts in road.

BROKEN FABRIC: Due to bruises, etc.

BLOW-OUTS: Caused by nail holes enlarged by dirt and water, or stone bruises of any kind.

RIM CUTS: Caused by under inflation, running flat, or misapplication of S. S. tires on Q. D. rims.

OIL AND GREASE: Caused by running on oiled roads, or greasy garages.

MISAPPLICATION: Improper way of putting the tire on the rim.

NAIL HOLES: Causing blow-outs and loose fabric.

RUN FLAT: Without any, or insufficient air.

The repairman should consider that his inspection and arrival at the cause of an injury should be handled in such a way that the customer is satisfied that he knows his business. Criticism of the customer's explanation should be avoided, a broad knowledge of the tire business making it possible to convince the owner as to the trouble.

Different territories and weather conditions will affect the mileage received and, while you may have a good understanding of the condition of a tire when used in your territory, consideration should be shown to the transient driving in from other territory.

In the inspection of a tire, defects sometimes show up that would not warrant making repairs should the customer desire it. Some of the defects found in tires are listed below, showing the possibility of adjustment.

BROKEN FABRIC: A possible adjustment, especially if in splice.

SEPARATED FABRIC: A possible adjustment at most times if the tire does not show signs of under inflation.

SEPARATED SPLICES: No adjustment. Should be cemented.

BUCKLED FABRIC: A straight adjustment, if out of service.

BROKEN ABOVE BEAD: No adjustment, if still good for service.

BEAD SEPARATION: Adjustment.

LOOSE TREAD: Possible adjustment.

SIDE WALL BLOWN: No adjustment, as this is caused by leaky tube.

BLOWN-OFF RIM: No adjustment.

BROKEN CABLE: Adjustment.

BLOWN AT SPLICE: Possible Adjustment.

IMPROPER CURE: Adjustment.

Under the present inspection at factories there is no such a defect

as defective fabric, as the mills are under contract for delivery of only first class fabric and the factory inspection culls poor fabric.

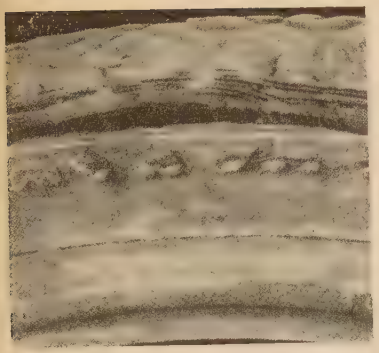
TUBE INSPECTION AND ADJUSTMENT.

The repairs to a tube consist of repairing holes, tears, blow-outs, new valve, new pad and splice.

Injuries or abuse, such as the following do not call for an adjustment: Blow-out, pinches, punctures, tears, run-flat, broken valve, leaky splice, deterioration.

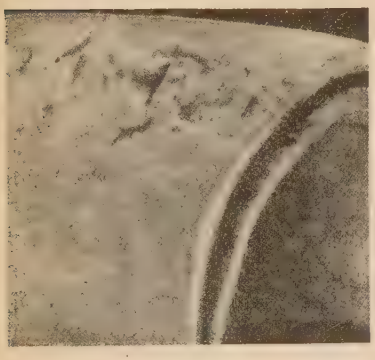
Possible defects are leaky splices, if not run flat, inside breaks and poor pad application.

THE ABUSES AND INJURIES.

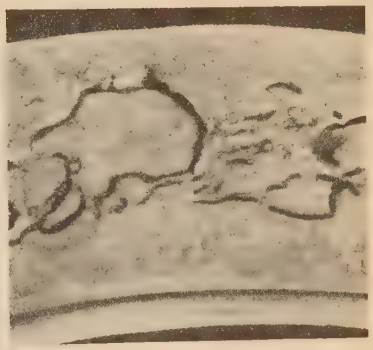


Damaged by Fender.

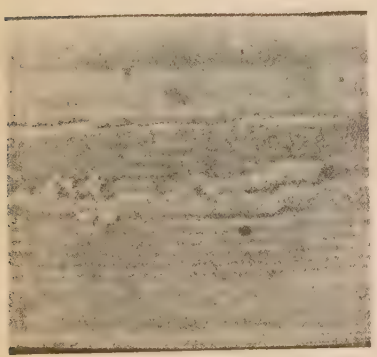
Anti-Skid Devices.



Neglected Cuts.



Snag or Rut Wear.

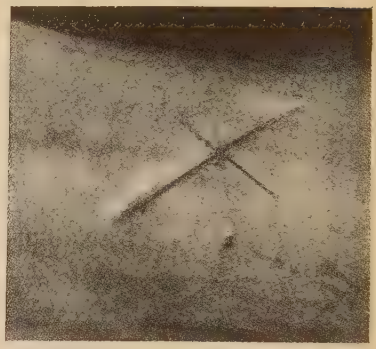


Wheel Alignment.

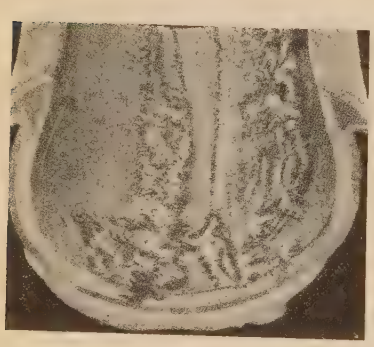
Ridden Flat.

THE ABUSES AND INJURIES.

Under Inflation.



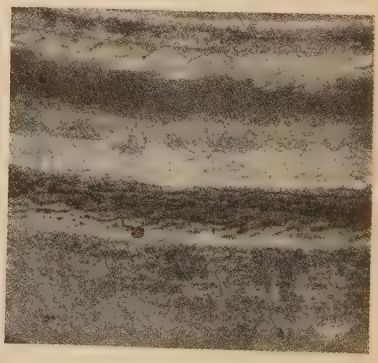
Ruptures.



Fillers.

Setting Brakes.

Oil and Grease.



Car Tracks.

CHAPTER V.

REPAIR SHOP TERMS.

The tire repair trade, like any other, has a term or expression used to designate an operation, material or method and these should be known so that an intelligent explanation can be given when used in connection with any part of the trade.

Kinds of repairs will be found under Inspection, Defects and Injuries.

GENERAL TERMS IN REPAIRING.

TREAD GUMS: A compounded rubber for outside use on tires.

CUSHION: A low gravity gum used for uniting fabric and tread gums.

SIDE WALL GUMS: Same compounded rubber as tread gums.

INSPECTION: The looking over a tire to decide repairs necessary.

NECESSARY REPAIRS: Result of a thorough inspection.

BEYOND REPAIR: Rejected for repair as mileage is less than the cost of repairs.

CLEANLINESS: An absolute necessity for good repairs.

DAMPNESS: Wet condition of fabric to be dried before repaired.

CEMENTS: Liquid cements for vulcanizing and uniting gums and rubber.

TERMS USED IN CUTTING DOWN A TIRE.

WEAK FABRIC: Fabric rotted by moisture, to be cut out.

LOCATING INJURY: Term used to designate the length of break or hole.

THE SPLICE: Where a layback section is started.

HIGH POINT: Highest part of a non-skid tire.

BLOCKING OUT: The stepping of fabric to be removed under the layback.

STRIPPING: Usually refers to removing the side wall.

BEAD COVER: A thin fabric around the bead, which is removed.

STEPPING PLY: The action of removing old fabric in blocks.

EXCEPTIONS: Refers to tires not of standard construction.

TOE OF BEAD: The point of the bead nearest the tube.

HEEL OF BEAD: The outside edge of bead.

SKIVING: Term used for narrow stepping or cutting.

BUFFING: An operation to remove dirt, old gums, etc.

RASPING: To roughen a tire so cement will adhere easily.

WATER: Used on knives to prevent friction.

TERMS USED IN BUILDING UP A TIRE.

BLISTERS: Small air bubbles in gum to be removed.

STRETCHING: The pulling of fabric on a repair to remove slack.

ROLLING: The forcing of repairs or gum to a single unit.

BUILDING: Replacing fabrics, gum, etc., on a repair.

NON-SKID: The raised or vacuum obstructions on a tire used for friction.

OVERLAPPING: Placing of materials across or over points.

TRIMMING: The smoothing of a repair before curing.

PERFORATING: The punching of an entire repair for air vents.

REINFORCING: The covering or building over of a weak place.

APPLYING: To add to when attaching gums, fabric, etc.

INSERTING: Refers to putting in reliner mostly.

BLOOM: Free sulphur on gums, etc., when aged. Wash off with gas.

TERMS USED IN CURING TIRES.

BAGS: A fabric and rubber bag used for inside pressure in mould.

TIME: The length of a cure.

PATCHING CEMENT: Air drying liquid for attaching impression pads.

TEMPERATURE: A gauge of the heat in steam required for curing.

PRESSURE: The required amount of force against all parts of a tire.

PET COCKS: Used for escape of pocketed air in moulds.

CIRCULATION: The passing of live steam through the moulds, etc.

THERMOMETER: A heat register for designating temperature.

SET-UP: The operation of getting a tire ready for curing.

CLOTH: Used to cover repair when in mould.

CLAMP: Used to force bead moulds together when setting-up.

RUBBER TESTS: The curing and testing of gum for proper cure.

UNDER-CURE: A soft condition of rubber not sufficiently cured.

OVER-CURED: A brittle condition of rubber cured too much.

POCKETING: A clogging of water or air in the moulds.

BLISTERING: A condition caused by insufficient pressure on a repair.

BLOWS: Caused by moisture or oil in a repair.

POROUS: Condition caused by insufficient pressure.

TERMS USED IN REPAIRING TUBES.

CUTTING OUT: The clipping away of broken rubber around a hole.

ROUNDING: Stopping the break in the grain of rubber.

WASHING: Application of gasoline to remove dirt, grease, etc.

BUFFING: Cleaning and roughing the surface of a tube.

CEMENTING: Applying liquid gum for uniting the gums of a tube.

BACKING: A repair gum with one cured and one raw side.

FILLING: Applying raw tube gum in the hole.

splices, etc.

PATCHING CEMENT: An air drying liquid for applying pads,

BLOCK: A rubber pad used for pocketing and pressing gum, in repairing.

TERMS USED FOR TEMPORARY SERVICE.

When short time does not allow for repairs.

BLOW-OUT PATCH: Made of several plies of fabric cemented together, to place over hole in tire on the inside.

LACE-ON BOOT: Used for same purpose as blow-out patch, only same is laced over the break on the outside of tire.

HOOK-ON BOOT: Same as lace-on boot. Hooks used instead of laces.

COLD PATCH: A quick tube repair by using air drying cement.

CHAPTER VI.

TIRE REPAIR TOOLS.

As in every other trade, the repairmen must have good tools. This is essential, more so than in most other occupations, due to the fact that it requires skill to cut down tires and to build them up. The following list of tools has been arranged for the bench at which they are used, a complete list being given with a description of the same. (The items marked * are the most essential.)

CUTTING-DOWN TOOLS.

WOOD MANDRELS: A wooden form made in sizes to fit on the inside of a tire when cutting down, to give shape at all times.

TACK BRUSH: A strip of leather filled with common tacks and fastened to handle for roughing splices on tires, etc.

WIRE BRUSH: For cleaning dirt and mud from tires.

*PINCHERS: Common carpenter's pinchers for pulling fabric.

*FABRIC AWL: Used for loosening fabric and prying.

PULLING HOOK: Used in place of pinchers for pulling fabric.

*FILE: For beading the fabric knife.

LOCATING AWLS: Shoemaker's awls for inserting at ends of break from the inside.

*RUBBER KNIFE: A 6-inch knife for cutting old treads and trimming.

*TREAD KNIFE: Can be made from a broken rubber knife about 3 to 4 inches long and rounded for cutting the tread back.

*FABRIC KNIFE: Made from old rubber knife about 1 1-2 inch long with bead filed in for sliting fabric.

*SAND STONE: Used on the bench for quick sharpening of knives.

PRODDING TOOL: A long, thin-bladed steel for inserting under fabric in tire to locate length of loose fabric.

*CEMENT CAN AND 4-INCH BRUSH: For holding and cementing tires.

BUILDING-UP TOOLS.

*Rollers: A round steel block with handles for rolling gums, etc., 2x2-inch size being sufficient for use.

*Stitcher: Narrow roller for uniting fabrics and use on gums made in smooth and corrugated edges.

*Rubber Knife: Same as used in cutting. Used for trimming the repair.

*Edging Knife: A short stub knife for inside cutting and trimming.

*Punching Awl: Short, sharp awl for perforating gums to release air and for perforating the whole repair for air vents.

*Tread-Guage: Used for marking the side wall with the bead as a line.

*Stretchers: Wood blocks for spreading tires when working on inside.

*Carborundum Stick: Used for knife sharpening.

Rasp: For smoothing or rubbing off surplus gums.

*Shears: Large scissors for cutting gums and fabrics.

*Rule: Used for measuring fabrics and gums.

TUBE REPAIR TOOLS.

*Roller: Same as used in building up.

Wire Brush: Used for roughing a tube repair when you have no buffer.

Valve Nut Wrench: A common S wrench will do; however, special wrenches can be secured.

*Small Brush: For cementing tubes.

*Cement Can:

*Straight Shears: Like shears used in cutting down, used for trimming tubes and cutting tube gum.

Curved Shears: Handy for rounding holes.

*4-inch Plugging Pliers: Used for moulding or forcing gum in hole.

Small Screw Driver: For loosening splices or valve pads.

STEAM SET-UP TOOLS.

*6-inch Knife: For spreading soapstone on non-skid tires.

*Screw Driver: For loosening bead moulds from the cured tire.

*Steel Brush: For brushing off soapstone.

*Rule: For measuring repairs.

CHANGING TOOLS.

1 2 3 4 5 6 7 8 9 10 11 12

1. Straight Roller. 2. Fabric Knife. 3. Concave Roller. 4. Perforating Awl. 5. Smooth Stitcher. 6. Corrugated Stitcher. 7. Rubber Knife. 8. Tread Knife. 9. Shears. 10. Fabric Probe. 11. Fabric Hook. 12. Pliers.

In many shops a service car is used for giving the customer service away from the shop and in many cases at places out of reach of the air line. It is very important that a box of tools for immediate service and quick changes should be at hand for this purpose. These tools should consist of the following items, at least, so that the man can take care of the charge on the ground: Set of changing tools, as hammer, 2 screw drivers, pliers, pump-jack, rim brace, chisel.

The service man should also have extra accessories, such as cold patches, blow-out patches, lace-on boot, with emergency tubes if possible.

CHAPTER VII.

CUTTING AND BUILDING FABRIC TIRES.

The following detail methods of repairing fabric tires are taken from practical work and advice of expert tire repairmen. The methods of cutting and building given here are those that have been found to give the longest service. The good points of all systems have been adopted, when practical. While many operations will be optional with the repairman, himself, he must use judgment at all times when engaged on the actual work.

GENERAL INFORMATION.

CUTTING DOWN:

1. All tires must be thoroughly dry for good work.
2. All dirt and dead material must be removed.
3. In making a repair aim to eliminate the injury and friction entirely or you will have trouble.
4. When cutting too deep always skive the fabric.
5. Step down all overlapped fabrics.
6. Skive down the hole when two more plies are left.
7. Round all breaks at end to stop further breaking.
8. Always wash all jobs with the best quality of gasoline.
9. Cut all splices at a slant for good connection.
10. Aim to make all cuts to the toe of bead, except last to heel.
11. Never attempt extensive repairs on casings with separated fabric, as the heat or cure will expand the air between the ply and increase the damage.
12. Repaired or retreaded tires should be put into service to get the best results.
13. Sectional repairs that go bad are due to the following reasons:
    (a). Not stepping the ply back far enough.
    (b). Failure to cover the fabric everywhere with cushion.
    (c). Lack of a thorough cure.
    (d). Uneveness in the repair which hinges and breaks through.

BUFFING:

1. Always buff the inside and outside of the repair, taking out all dirt and dead material. Carry the buffing over the repair slightly to rough the job so that cement will adhere easily.
2. If the buffer does not reach all points, use scraper or knife, after softening with gasoline.
3. Use a rougher on splice edges and tread edges to give a rough surface for cement to run into.

CEMENTING:

1. All repairs must be dry before cementing.
2. Two coats are applied. Each coat to dry fully. This depends on the weather conditions.
3. Brush your cement over the job slightly to allow for trimming.
4. Always run cement between loose fabric.
5. Use only the best grade of gasoline or benzol in making cement.
6. Cemented tires should not be placed in a draft as the cement will crust over and remain damp underneath.
7. Cement can be dried too long and lose adhesiveness.
8. Cushion gums and scrap fabrics will make good cement as they are of low specific gravity.
9. Cement can be made by mixing one pound of cushion gum with high grade gasoline and stirring regularly. Add one ounce of wood alcohol for cutting.

BUILDING:

1. Always keep stocks on the building bench in a fairly dry place.
2. Stock should be covered from dust, soapstone, etc.
3. Hang your stocks up on rolls. Never place on end.
4. Cut all your fabric on the bias.
5. Trim all selvages from bareback and fabrics.
6. Lap fabrics when connecting.
7. Strip bareback when connecting with cushion.
8. Have your cement dry before working on the case.
9. Have no soapstone or oil on gum when using. Wash off with high test gasoline.
10. Always take out all blisters from gums and cushions.
11. Stretch all fabrics when applying to the job.
12. Roll all repairs before trimming.
13. Perforate all jobs for air vents before curing.

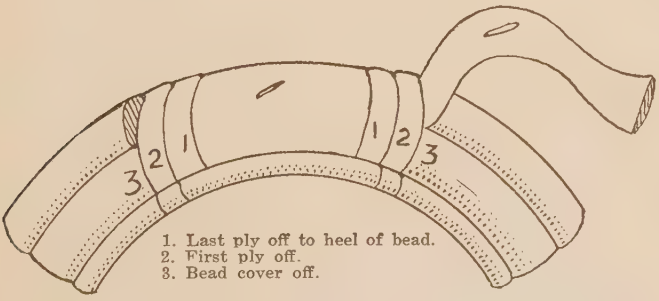
14. General building is to take the first ply to heel of bead and carry other ply to toe of bead. Some exceptions occur.
15. If tire is weak on the side wall carry a ply inside the tire.
16. When large tears are repaired stitch with thin bead fabric cut straight.
17. Do not lap the first ply of fabric over the hole.
18. Do not carry spliced fabric over the bead.
19. Trim all edges and splice down before curing.
20. Always fill holes with cushion.
21. Never fail to cover the fabric on top with cushion.
22. Endeavor to keep uneveness out of the repair as it usually hinges and breaks.
23. If gums stick to the cloth wet the other side with gasoline.

NOTE: Should you run out of fabric or bareback at any time you can use the ply from another tire by cementing same two coats.

The above general information should be followed at all times as it is care, cleanliness and attention to the small things that make it possible to turn out repairs that the repairman can stand back of with a guarantee. Remember that doing work over is the outcome of carelessness for which there is no excuse. Repairs in tires will outlive the tire itself if done properly.

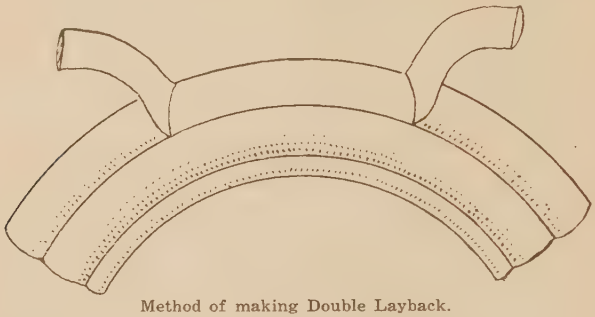
DETAILED DESCRIPTION OF CUTTING AND BUILDING FABRIC TIRES.

The following description of operation shows each and every step on the various kinds of repairs done in the shop and can be referred to or followed on actual work. Some repairs or operations which are



Last ply usually off at heel of bead. Some repair-men end it on the side wall. Others take all ply over.

similar are referred back to a preceeding operation. Bear in mind that any repair man that can cut down and build up a complete lay-back section can do any work in the repair trade with the use of a little judgment and common sense.



Method of making Double Layback.

CUTTING DOWN A COMPLETE LAYBACK SECTION:

1. Never attempt sectional repairs on a tire with loose tread or loose fabric in many places.
2. Be sure of your decision of the kind of repair to be made before starting to work.
3. Locate the length of your injury and dead fabric if any.
4. Measure the length to cut your splice from the end of break according to following scale: (3-inch tires, 3½ inches) (3½ and 4-inch tires, 4 inches) (4½ and 5-inch tires, 5 inches).

This is for the single layback section. When the tread is laid back run it about one to three inches past the end of the break, to take up the turn of the layback.

NOTE: Some repairmen start their splices in the center of the repair and lay back both ways. This method is optional, although the writer believes the single layback the more practical as it leaves one end free to work over and also carries the splice away from the hole, as this is filled up with gum and is therefore yielding, giving movement to the splice with a tendency to loosen up. Where the break is across the tread completely make a double layback.

5. When you have located the place for the splice, cut across the tire, slanting the cut 45 degrees to give more surface for uniting again. Go through the breaker.
6. On non-skid tires cut the splice at the highest point as this will give better pressure in the mould when cured.

7. Cut under the sides of the tread on both sides, the length of the section until you reach the first ply fabric and then pull the tread back, cutting it away with the tread knife as you go.
8. Block out the ply to be taken out on the surface exposed; this lines up your repair in 1-inch steps.
9. Strip down the side walls straight from the splice end and about one inch from the curved layback on both sides and remove the side walls.
10. By following the lines down No. 9, you will find, in many cases, the bead cover about one inch above the bead, which is cut over the bead and removed. Should the tire not have a bead cover, trim the side wall off anyway, and tread as if it was there. The last ply on takes the position of this bead cover when removed.
11. You now continue the blocking which was previously stepped down in steps of one inch on the top and take out the first ply of fabric down over the bead to the toe.
12. The second ply is taken out down to the heel of the bead if only two plies are removed; if more than two plies were removed in large tires, this second ply would go over to the toe of bead and the next would stop at the heel.

    NOTE: We will state here that some repair shops stop the second ply off on the side wall and aim to put back two ply only. However, this system will call for three ply back on, and for this reason you can carry it to the heel of the bead. The first ply on, in both cases, goes to the heel of the bead.
13. As you repair large size tires it will be necessary to remove more ply of fabric and the following scale will be found practical to use:

    Form 3-inch, 3½-inch tires, fabric, take out two plies.

    " 4½-inch and 5-inch tires, fabric, take out three to four plies.

    " 5-inch and 5½-inch tires, fabric, take out four to five plies.

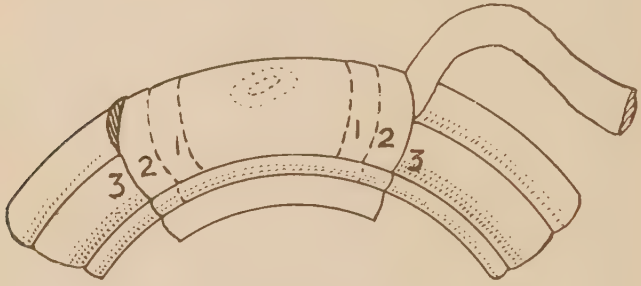
14. When you are cutting down a S. S. Dunlop tire you will find that after you have cut out your first ply, that a ply comes up the side wall over the bead from the inside. Do not cut this out, but pry back and cut your second ply under it and build under it, as it holds the bead on the Dunlop type.

15. If you wish to, you can cut the first ply off diagonally on the side wall when there is no bead cover and let it take the position of the bead cover.

16. Skive the hole down and trim out the tread break.

You can now buff and cement the tire as shown under general information.

BUILDING UP A COMPLETE LAYBACK SECTION:



1. First ply on to heel of bead.
2. Second ply on to toe of bead.
3. Last ply on to toe of bead.

Build up as taken off, allowing 1 / 16-inch lap.
Carry last ply inside tire on S. S. and weak bead tires.

Strap your tire on the mandrel by using fabric waste.

1. See that your cement is dry.
2. Apply cushion over the hole, and in same.
3. Next cut fabric to fit the first block-out, allowing about 1-16 of an inch overlap. Fit the fabric and stitch down and trim at the heel of the bead.
4. The second ply is cut to fit the next block-out, allowing 1-16 inch for overlap and this ply is stitched down over the heel of bead and to the toe, where it is trimmed.
5. The third or last ply is placed about one inch over the whole block, or up to the splice, on one end, so as to clear the curve of the layback on the other end and is carried down, taking the place of the bead cover cut out. This last ply can be carried over the toe and inside the tire if the side is weak and it is a good thing to do this in all cases on straight side tires.

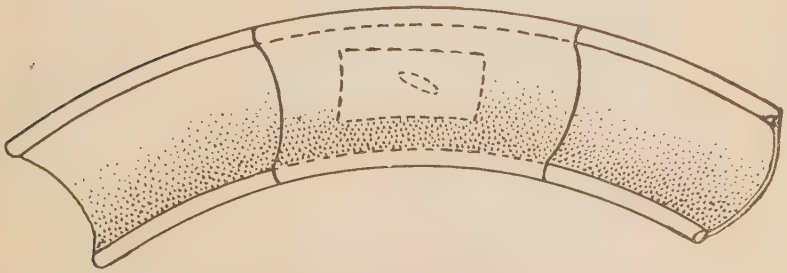
NOTE: We will add here that in case you only put back two ply, as some shops do, the build-up is the same, except that the first ply on is left out. The other two ply are identical, except that one ends at heel of bead. Should you be using

reclaimed fabric from old tires, be sure to see that same is cemented thoroughly and is in good condition.

6. Now cut a ply of cushion wide enough to cover the fabric on top and a little below the tread lines on each side, and long enough to butt up on the layback and come down over the splice end. Fit and roll the cushion down.
7. Cut two strips of 1-16-inch side wall gum to match color, when cured, and apply on the sides for side wall, starting same just over the bead line and bringing it up above the tread line, where you will trim smooth.
8. Now wash the whole surface where the tread comes down with high-test gasoline to remove oil, sweat, etc.
9. Back up your hole in the tread with cushion and pull your tread down and fit snugly to the splice. Roll well.
10. Should you have to apply new tread, see tread section for build-up.
11. Perforate your whole repair well for air vents and trim down smooth.

Reinforcing the Layback Section:

12. You now place your tire on the hook and work on the inside.
13. If you are carrying a ply over inside the tire, stitch it down.
14. Fill the hole on the inside with cushion and stitch.
15. If a small hole, apply a piece of fabric to cover well and stitch down. If a large hole, put in a ply of fabric from side to side, and trim about 1-2-inch from the toe of bead. This should be about the size of the outside section.

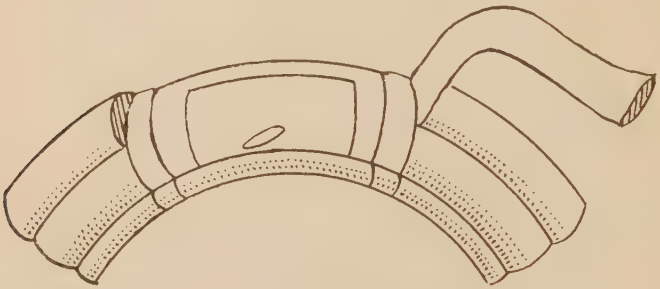


SECTIONAL REINFORCEMENT.
If a small hole, use piece of scrap fabric; if large, fabric from bead to bead. Trim ½-inch. Cover with Bareback.

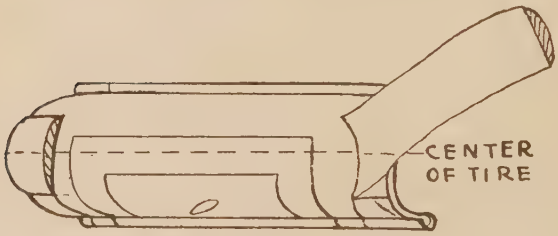
16. Cover the whole inside with a ply of bareback, from bead to bead, cutting the bareback about 1 1-2-inch longer on each end, to cover the whole repair.

Your tire is now ready for set-up at the steam bench. See curing scale and set-up.

LAYBACK SIDE SECTION:



LAYBACK SIDE SECTION.
Same as Complete Section, leaving on sidewall.



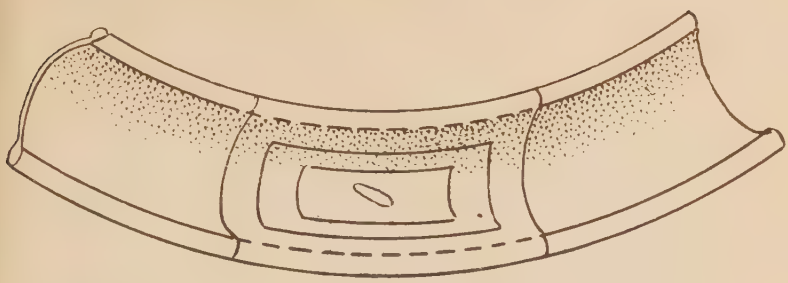
How the Fabric is taken out on top of the tire.
Never cut in center.

The side section is exactly the same as the complete layback section, except that only one side wall is removed. In other words, it is a three-fourth section and should be used on short rim cuts and breaks on the side of the tire, to save material.

The only point to remember on this repair, is to cut the first ply out about 1 1-2-inch from the tread line to allow for lapping over on the build-up. The second ply off is taken off on the other side, about the same position; the idea being to keep from cutting or ending a ply in the direct center of the tire.

Some repairmen would make the side repair without removing the tread, which can be done, but you will find your work holding up under the heavy wear, if you carry it over.

CUTTING DOWN INSIDE SECTION:



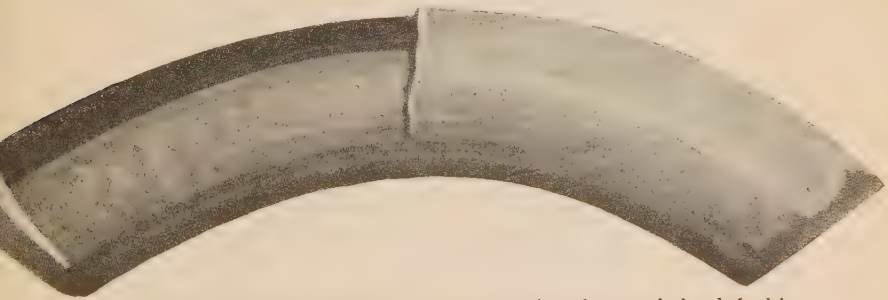
First ply off from bead to bead. Block others inside the bend of bead.

1. Block out the first ply of fabric on the inside of the tire from bead to bead.
2. The second ply off should be inside the bead bend, if only two ply are taken off. If more than two are taken off in big tires with a large blow-out, you can step-in in the center of the bead. Never cut a ply of fabric or apply same in the bead bend. It will start a rim-cut.
3. If the hole is small and the tire large, you can step-down in the center of the tire on 1 1-2-inch steps, or larger.
4. Cut your tread repair for a tread patch if the hole is through on this repair. See tread patch. Buff and cement.

BUILDING UP INSIDE SECTION:

You can now build your tire up step for step, like the reinforcement, filling the hole with gum, and covering with bareback from bead to bead. Put back as many ply as taken out.

CUTTING DOWN TREAD SECTION:



1. Cut out all loose tread, including the breaker and dead farbic, if any. Do not hesitate to cut down in the carcass to get the dead fabric, as this must be removed.

2. In cutting the tread, where it is solid to the tire, slant it as you would a splice on a layback.
3. Buff and cement.

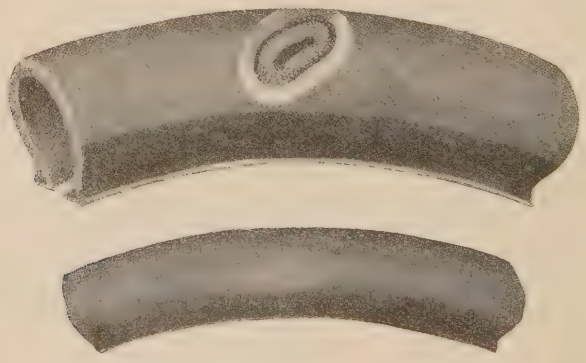
BUILDING UP TREAD SECTION:

1. In some cases you may block-in with fabric.
2. Fill the holes, etc., up with cushion.
3. Cover the whole surface with layer of cushion to overlap the sides and end.
4. Apply a strip of breaker.
5. Fill up with tread gum in steps to bring high enough to match rest of tread, allowing each ply of tread gum to overlap the end enough for trimming down and giving good joint, and stepping up to the center.

   NOTE: Should you desire to, you can take a similar section of a tread from a junk tire, buff and cement it and apply it on, taking care to match end and fill with cushion. This is one way of applying a non-skid to a tire. Should the tire be a non-skid, and you are building up with raw gum, allow for the flow of gum to come up, even if you had to use an impression pad.
6. Reinforce the tread section with the same kind of reinforcement as a layback section.

Set up and cure.

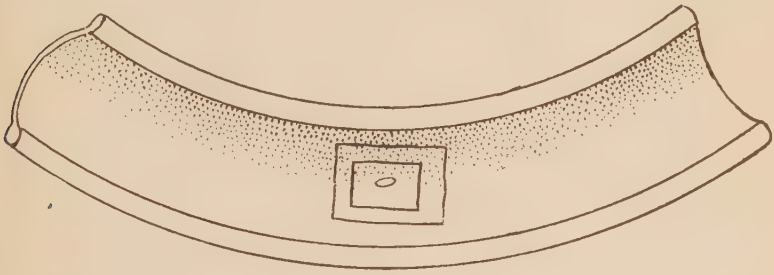
TREAD PATCH:



1. Cut out the broken and loose tread spot, breaker and dead fabric, if any, and slant as you would a splice.
2. Buff and cement.

3. Build up by filling with cushion into the nail hole, if any, and cover with cushion to overlap.
4. Fill in and stitch down pieces of tread gum until as high as the old tread and trim off.
5. Reinforcement to consist of one or two plies of fabric stepped-in and bareback patch to cover over the well.
6. Set up and cure to scale.

SMALL REINFORCEMENT:



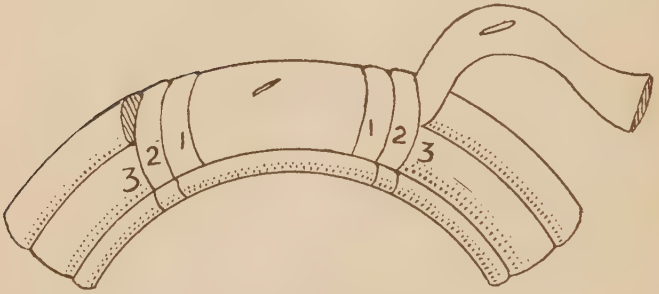
Step down slightly for nail holes. Tread Patch usually on outside.

1. Step down the nail hole or small cut in one or more steps as required.
2. Buff and cement.
3. Building is done in steps as taken out.
4. Cover with patch of bareback.
5. This reinforcement is used to back-up a tread patch, the large reinforcement being used for the tread section.

CHAPTER VIII.

CUTTING AND BUILDING CORD TIRES.

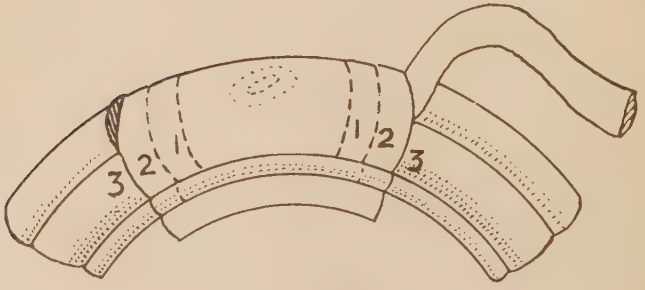
WITH COMMON FABRIC.



CUTTING.

3. First ply off to heel of bead.
2. Second ply off to top of bead.
1. Bead cover off.

Cord Fabric Tires are cut down as fabric when build-up is of fabric. Fine Cord Fabric Tires required two plies out at a time for one of common fabric put back, except Firestone. Steps can be made wider if desired.

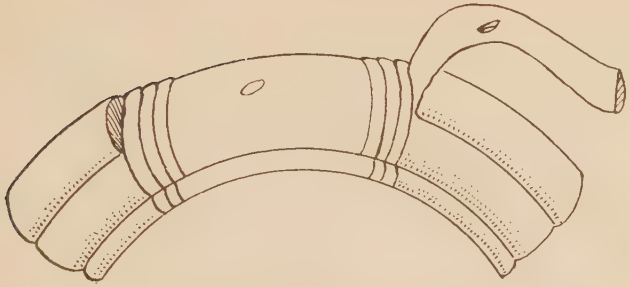


BUILDING.

1. First ply on to heel of bead.
2. Second ply on to top of bead.
3. Third ply on to top or inside.

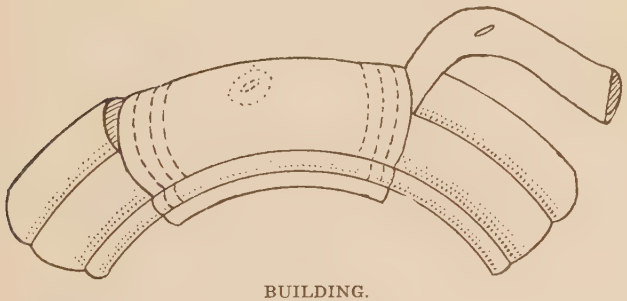
Cord Fabric Tires are built up same as Fabric Tires. When using Common Fabric apply one ply for two of cord fabric out, except Firestone.

WITH CORD FABRIC.



CUTTING.

When cutting down for build-up with cord fabric cut out ply for ply, however the steps can be shorter in large tires, ⅝-inch steps being enough.



BUILDING.

Build up with Cord Fabric ply for ply, same as Fabric Tire.

CORD FABRIC TIRES.

Cord fabric tires, such as U. S. Royal, Miller, Firestone, Goodyear, Horse-shoe, Racine, etc., are built at the factories on about the same construction as the regular fabric tire. For this reason the cutting down and building up is similar.

CUTTING DOWN COMPLETE LAYBACK SECTION:

1. Locate the injury and cut a splice, using about the same distance as on fabric tires, or slightly more.
2. On a large tire you can cut your splice in the center of the layback, if the cut is across the tire.
3. Layback the tread.

4. Block-out the fabric for the necessary ply-out.

   NOTE: At this point it is determined how you will cut out your steps. If you are using common fabric for the rebuild, you will cut two ply of cord fabric out as one on this type of tire, except Firestone, which has a cord fabric about the same thickness as fabric. The other tires have finer cord fabric and it takes about two plies to make up the common rebuilding fabric. The steps in this case are 1-inch to 1 1-2-inch. If you are rebuilding with cord fabric you will have to cut down step for step about 3-4-inch to each step. In large 6-inch tires there are about twelve plies of cord fabric which should be stepped down at least eight plies. You would in this case make your splice far enough back to take care of the steps.

5. Usually aim to leave about 3 plies in 5½-inch and 6-inch tires. When more plies are left skive down.

6. On large tires (bus), now in use (6-inch being the most common size), most of the fabric layers end at the heel of the bead. Care must be taken to put these back the same way.

7. When you have to cut out six to eight plies and the injury is in the center of the tire, one or two cuts can be ended on the side.

8. Buff and cement.

BUILDING UP COMPLETE LAYBACK SECTION:

1. Build up as you would a fabric tire, applying step for step, with 1-16-inch lap, and should the plies end on the side wall when taken off, place them likewise on the build-up.

2. Finish on larger tires by adding a bead strip or cover up under the side wall and over inside the tire.

3. The last ply of cord fabric should be carried over and inside the tire.

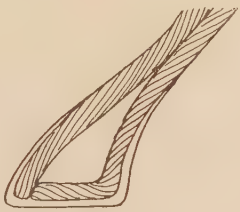
4. Reinforce the same as a fabric tire.

5. Trim, set and cure, according to scale given.

   NOTE: All other repairs, such as a side section, the tread section, the tread patch and reinforcement, retread, etc., are along the lines of the regular fabric tire.

CABLE CORD CUTTING AND BUILDING.

Quick Detachable Types A, B, and C.



Straight Side Types A and B.

Straight Side Type C.

General Information on Cable Cord Repairs

NOTE: The following detailed information covers the B. F. Goodrich silvertown cord repairs, which can be applied to repairing other kinds of cable cord tires, as well.

Goodrich silvertown cable cord tires are of entirely different construction from the fabric or cord fabric tires and for this reason quite a close study of the cord position in the tire.

As we have said, the cable cord tire is made of two and sometimes three plies of heavy cable cord. In the silvertown cord, two plies or layers are used, each ply being diagonal to the other. The greatest amount of study should be the bead construction in the quick detachable and the straight side, for the purpose of taking out the cords and replacing same.

The quick detachable bead of the silvertown runs in three types, which refer to changes in capacity and size of cords. The bead is the same in all three, namely looping the cable cord over staples in the bead core in each ply. It is necessary to pull out the staples to remove the cords.

The straight side bead is somewhat similar to the fabric bead, that is, the cords end on the bead in a certain position as the types call for. There are three types in this style of bead, as in the Q. D., namely A, B, and C construction. The A and B types were found in the early tire, with the cords ending at the toe of the bead and bound by a heavy bead cover; while on the C construction, the inside cords loop under to the heel of the bead and the outer cords come

over inside the tire and up about one inch, this being bound by heavy bead cover.

When the silvertown cable cord was first put on the market, it was repaired from the inside and outside on all types, that is, the tread was removed or laid back for outside cords and the cords inserted in the same way. Under this method it was necessary to split the bead core on the Q. D. to get the outer cords out, and the tread was affected in all cases. Now every type can be repaired from the inside, except the C construction, S. S., which is repaired from the outside, due to the fact that the cords lace over each other and it is difficult to pull the outside cords through the side wall and put them back. The only time that a bead is split now, would be in repairing an injury to the bead or when a new piece is put in.

General Information:

1. All types of quick detachable tires in A, B and C construction can be repaired from the inside without affecting the tread or splitting the bead.

2. Both types of straight side tires in A and B construction can be repaired from the inside without affecting the tread.

3. The straight side tire in C construction is repaired inside and outside, depending on whether the inside or outside cords are broken.

4. When buffing sections on cord tires, buff them until the cords shine, and rough as much as possible.

5. Never use fabric in covering breaks in cord tires.

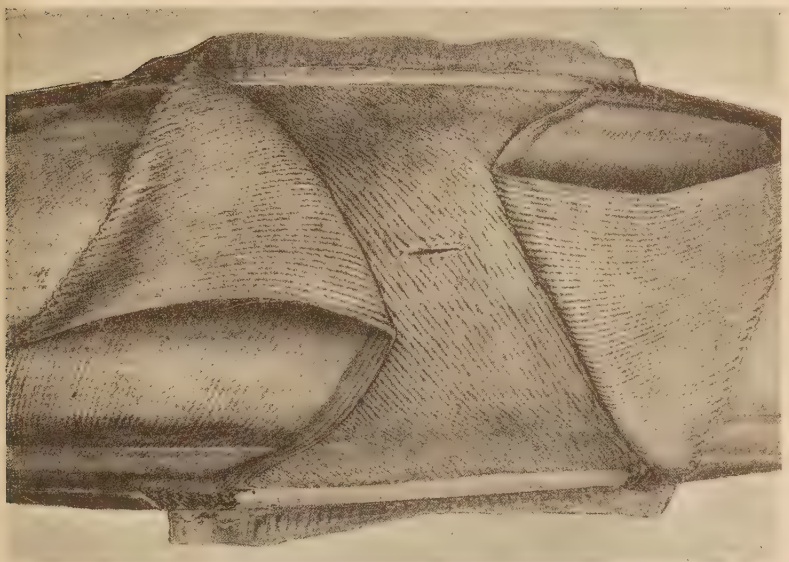
6. Cords for repairing can be secured from any other cord tire of its type, which has been junked.

7. Use as much as possible all repair materials as made by the individual manufacturer of the cable cord tire. Write for catalague.

8. In nail holes, when only a single cord is cut, a split repair can be made by inlaying a short piece of cord and covering with a puncture patch.

INNER AND OUTER CORD SECTION.

Except C Construction S. S.



All types Silvertown Cords are repaired as per drawing except C Type S.S. On the outer cords the side wall is merely cut or buffed off to allow for drawing the cords through and replacing them.

Cutting Down Inner Cord Section:

1. Turn the tire and locate the broken cords.
2. Pull the broken cords across to the side each way, which will show point to remove bead cover.
3. Cut the bead cover or chaffing strip about two inches each way from the ends of cords to be removed and layback or remove. Pull staples if Q. D.
4. Cut the cords at the turn of the staples, if Q. D., and pull out the broken or injured cords.
5. Select new cords for the same type and size tire and fit, being sure to fit the cut ends as taken out.
6. Buff and cement the tire and the cords.

Building Up Inner Cord Sections

1. Put in a layer of 1-64-inch cushion gum so that same will lap over the remaining cords slightly.
2. Fit the new cemented cords and stitches down in place.

3. Put in new staples by forcing in with pliers, if a Q. D. Should your staples not fit easily, use an awl to open the hole up.
4. Now cover the new cords and the bead with a layer of 1-64-inch cushion.
5. Cover the bead with two plies of bead cover if the old cover is no good, with first ply to fit from toe of bead up one inch on the cords, on the inside; second ply 1-2-inch above the toe of bead, 1 1-2-inches on the cords on the inside.
6. Set up with an impression pad and cure to scale.

NOTE: When putting an inner cord section in a C construction S. S. tire, layback the bead cover and pull the outer cords away to get the inner cords out, as the outer cords lap the inner and come up inside the tire a short distance.

A AND B TYPES.

CUTTING DOWN OUTER CORD SECTION:

1. Repair all Q. D. tire sections from the inside.
2. Cut away the bead cover on both sides for a complete outer cord and inner cord section, allowing two inches from where the cords come out.
3. Pull the staples on both sides, if a Q. D.
4. Split the inner cords at turn on staples and layback all cords so that the broken outer cords are exposed and clear to the staples.
5. Split the outer cords at the staples and pull same. Outer cords are taken out after the side wall has been cut off or buffed sufficiently to clear the cords to be removed and the bead cover has been completely removed. This allows for the pulling the cords through and also for replacing.
6. Select and fit new outer cords.
7. Buff and cement.

BUILDING UP OUTER CORD SECTION:

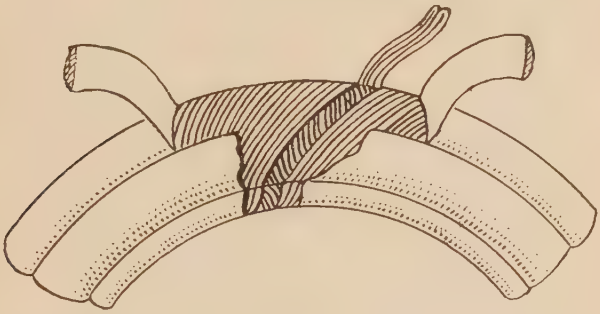
1. Lay in a layer of 1-64-inch cushion to lap over the remaining cords.
2. Insert the outer cords.
3. Lay in a layer of cushion between the inner and outer ply.
4. Replace the inner plies and stitch down.
5. Replace new staples.

6. Cover the complete section with 1-64-inch cushion.
7. Apply the bead cover as shown under inner cord section.
8. Set up with impression pad and cure to scale.

INNER AND OUTER CORD SECTION.

This is only the same operation as you will find in an inner cord section and outer cord section. Follow same steps.

"C" CONSTRUCTION TYPE.



As the outer cords go over inside the C Type S.S. Tire, repair from the outside. Inner cords on this type are repaired from the inside.

Cutting Down Outer Cord Section:

1. Cut a splice through the center of the proposed section, usually through the break, as a double layback is practical.
2. Lay back the tread on both sides to clear space required for pulling out broken cords.
3. Cut out the side wall at a slant for removing the cords.
4. Take off the bead cover, inside and out, allowing two inches each way.
5. Pull your broken cords, which you will find go over the bead and up on the inside.
6. Fit new cords of same type.
7. Buff and cement.

Building Up Outer Cord Sections

1. Apply layer of 1-64-inch cushion gum.
2. Insert the new cords and stitch down.
3. Apply layer of 1-64-inch cushion over the new and old cords.
4. Apply the side wall and smooth up under the tread line.
5. Cover the bare tread with 1-32-inch cushion and bring down the tread layback, fill, trim and cure to scale with impression pad.

NOTE: When making an inner and outer cord section repair on this type, repair the inner cord section from the inside, as you would earlier types.

CUTTING DOWN CORD SEPARATION, ANY TYPE:

1. Cut off the bead cover on the inside. On type C, S. S. tires, cut the bead cover over the bead in order to pull or pry the outer cords back.
2. Pull one side of staples, if any.
3. Split and layback all loose cords.
4. Buff and cement.

BUILDING UP CORD SEPARATION, ANY STYLE:

1. Apply layer of 1-64-inch cushion.
2. Fit the cords and insert staples, if Q. D.
3. Apply the bead covers.
4. Set-up and cure with impression pad to scale.

TREAD PATCH:

1. Cut off the old tread and breaker, where loose.
2. Buff and cement.
3. Cover with a layer of cushion.
4. Fill with black tread gum. Trim.
5. Set-up and cure with impression pad to scale.

Q. D. BEAD REPAIR WITH NEW PIECES OF BEAD:

1. Trim off the side wall up 1 1-2 inches.
2. Cut off the old bead cover, inside and out
3. Pull staples on inside, if necessary.
4. Split the bead half way between the heel and toe.
5. Cut the outer half of bead at ends and remove.
6. Fit new pieces of bead and fill split with gum.
7. Put back new bead covers.
8. Add your side wall, set-up and cure to scale.

STAPLES, IF Q. D.:

1. Layback the bead covers, to save if possible.
2. Pull all staples. Buff and cement.
3. Insert new staples.
4. Apply layer of cushion 1-64-inch, all over the staples.
5. Pull down and stitch old bead cover or add new one.
6. Cure in the sectional mould with pad to scale.

CHAPTER IX.

RETREADS.

Retreading tires, both in cord and fabric construction, requires more care than any other part of the repair trade. All blisters and air must be worked out and absolute pressure at all points is essential. The lack of sufficient pressure in wrapping is the cause of most retreads going bad or coming loose, as it is out of the question to expect a tread to hold up when there are loose spots in the tire when it comes out of the kettle or mould.

Never retread a tire with loose fabric, wet spots, or dirt between the plies. Should you not be able to eliminate the wet condition or dead fabric, do not attempt the retread.

The retread band has been found to be the most practical way of retreading a tire of any kind, due to the fact that it has been semi-cured or completely cured under heavy pressure, and is in a massed unit, without the blisters. The present cloth hand wrapping will apply enough pressure to cure and unite the band if properly applied.

At the present time, there are in use three distinct ways of building up a retread, two of which can be combined at the bench. One method is to build up with steps of raw gum until the proper thickness is applied. Another is by the use of camelback which is the raw gum already formed like the tread and is applied at one time. The repair man can build up the raw gum into the shape of camelback and apply as a unit. The other way is to use the semi-cured or cured retreading band.

CUTTING DOWN A RETREAD:

1. Take your tread gauge and make a line on both sides of the tire, usually about 1-2-inch below the original tread line.
2. Cut to this line by slicing off a width of the tread, completely around the tire on both sides. On fabric tires you can usually pull the balance of the thread off with the breaker. On cord tires, however, it is usually necessary to cut the tread off in strips until through. Aim to skive or bevel the upper edge of the side wall.

3. Buff your tire thoroughly and roughen.
4. Before cementing the tire, hang it up for drying out of all moisture.
5. You can now apply your cement, three coats giving the best results, although two coats can be used. Dry the first coats for at least two hours, depending on the conditions you are working under. The last coat on should dry from four to six hours. Never put the cemented tire in a draught to hasten drying, as it will coat over.

Building Up a Retread:

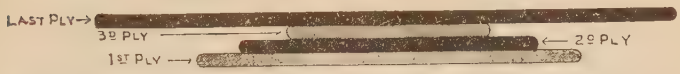
1. Now apply your cushion gum on the tread and carry same down so that it will lap slightly over the side wall. When putting on cord bands, use 1-64-inch cushion and when putting on raw gums or on fabric tires, use 1-32-inch cushion gum.
2. If you are using tread gums only, you can now apply layer after layer of 1-16-inch tread gum, starting the first layer about one inch from the side walls and then stepping-up plies enough for the required thickness, allowing for the last ply or cover to fit down over the side wall slightly, for trimming. The last ply gives a smooth surface to the retread.

If you are using camelback, merely apply on the tire if wide enough, and if a little narrow, strip the side wall with raw gum to take up the space. The same applies to the retread band to allow for trimming.

If you are using a retread band the inside should be cemented in the same manner as the tire and dried likewise.

3. Now place a wide piece of white or clean muslin around the tire to keep the band from sticking to the tire when slipping same on the tire.
4. In centering the band, you are to bear in mind that the sides of the band should not be the edge to center to, but the rib or the side of the raised non-skid should be used. You should now use the dividers or rule and center the entire band.
5. After the band is exactly in center pull the muslin out carefully without moving the band and stitch and roll the whole band very carefully from the center and working toward the outside, using the perforating awl to let any and all air bubbles or blisters out.

6. In some cases it is necessary to cut a retread band or splice to fit a smaller tire, in which case always cut the splice at a slant, as you would in making a layback section.
7. You are now ready for set-up and cure which will be found under set-up and steam.



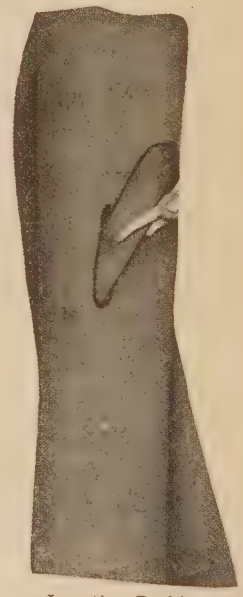
SHOWING CONSTRUCTION OF RETREAD BAND WHEN BUILT OF RAW GUMS.

CHAPTER X.

TUBE REPAIRING.

Tube repairs will be found to be the easiest part of the repair trade and it is no doubt for this reason that so little attention is given to the proper way of doing the work by the repairman, when in fact the skill of the workman should be shown in his tube work and the way it appears when completed.

Hole Trimmed.



Inserting Backing.

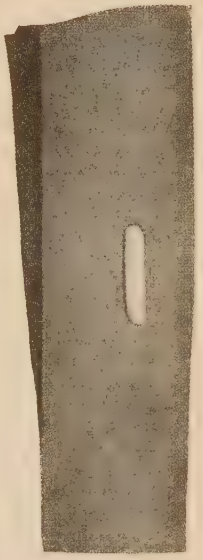
There is no excuse for bungled patching on tubes, either in holes, splices or valve pads, and when a tube leaves the shop it should be in a condition that will give long-lived service. In fact a hole repaired properly should never blow out or leak in the same place, unless abused.

If a tube is in a poor condition when it is brought in, do the same as you would on a tire, inspect it thoroughly and if beyond repair,

junk it, as this same tube, if only capable of short service, in many cases would injure an expensive tire in going flat at the wrong time.

Tubes, like tires, are the regular sizes and oversizes, and a tube should be placed in the tire of its own size, never crowded in to cause creases, if avoidable.

Ready for Cure.



Cured.

General Information:

1. When a tube comes in on the rim and you find by the test that it shows a hole caused by a small nail, look in your case and take it out. If there is a small fabric break send your tire through for a reinforcement or tread patch, or otherwise if badly damaged.

2. When you get new tube gum take a rubber test to determine the time of cure on your plate. Cure the gum about the required time and when cool cut in two pieces. If over-cured, it will be brittle and break off, if under-cured it will stretch long and remain longer than the other part. You can then increase or shorten your cure.

3. Fifty per cent of the slow leaks in a tube which do not show up in the testing tank are caused by the valve nut being loose.

Always tighten this nut on every tube that goes through your hands and you will have satisfied customers.

4. Red tubes cure in about the same time as grey tubes or slightly less.
5. On small clincher type tubes, also use a small valve.
6. Buff and bevel every tube hole or tear.
7. Always wash all jobs off with high-test gasoline.
8. Cement the hole inside and out.
9. Tubes ordinarily cure in about fifteen minutes at fifty pounds.

REPAIRING HOLES:

1. Cut out the hole in a rounded shape on the ends of the hole or tear.
2. Buff inside and out and bevel on the emery.
3. Wash inside and out with high-test gasoline.
4. Cement with vulcanizing cement inside and out, and let dry.
5. Cut a piece of backing or combination gum so that it will overlap the hole or tear on the inside. Dip in gasoline and insert through the hole and fit. Roll down well.
6. Take tube filler gum, usually about 3-32-inch thick, and cut a narrow strip and plug in the hole, starting along the outside edge of the hole and working around until the center is reached, aiming to keep the center a little higher than the flush edges. This will flow your gum to the sides and make a smooth repair.
7. Stitch the filler gum down so that it binds to the edge of the hole.
8. A good binder for the whole repair, now, will be to take a narrow strip of 1-32-inch tube gum about 1-4-inch and seal the edges of the hole with the new gum, this being the reason for cementing the outside about 1-2-inch around the hole. By doing this the direct straight connection of the edge of the hole and the new gum is bound tightly and will never crack or pull away.
9. Your tube is now ready for curing. Either cover your tube plate with holland, or place a piece of holland cloth over the new gum and place on the tube plate to keep from sticking.
10. Some small holes can be rivet-type cured, by cementing and pushing gum through the hole, but it is better to cut a hole

sufficiently to put a small piece of cloth in for washing with gasoline on the inside; the stock amounts to very little.

11. When repairing a hole near the valve, always remove the valve and slip inside the tube. You then have a flat surface to work on.
12. Holes in splices, which have been united by patching cement, or acid cure cement, in many cases call for a splice section, as the heating of the patching cement loosens up the whole splice. Cured splices, however, can be cut out in a small hole and repaired easily.

VALVE PADS:

1. Remove the valve nut, bridge washer and lead seal, and slip the valve into the tube. Never pull a valve out through the same holes, as it will, in many cases, cause trouble later on by breaking the fabric in the pad.
2. Heat the old pad, if put on with patching cement, and pull off if possible; if not, buff and repair the hole.
3. Buff and wash with gasoline another place on the tube and cement with patching cement, if using same, or vulcanizing cement, if curing.
4. Also buff and wash the pad and cement likewise.
5. When patching cement is used, use two coats, allowing each to dry and then apply the valve pad on the tube and stitch down and roll well. You can then take a common trimming knife and squeeze the hole in the pad up and cut out the round hole required for the valve in the tube. If using the cure method, cement and cure on the plate.
6. Now slip your valve in and put on the nut, etc.

VALVES:

1. Old valves can be used by buffing and rimming.
2. Use the small valves on 3-inch tire clincher type tubes.
3. Cut a hole in the tube for taking out the old valve and inserting the new valve. Never pull a valve through the valve hole.
4. When putting on the lead washer, bridge washer and valve nut, bring them up tight.

SPLICES:

1. The splices in tubes are usually cured or united with acid cure cement. For this reason a leaky splice with acid cure usually calls for a new section.

2. To loosen an old splice with acid cure, heat about five minutes on the plate and pry apart.
3. The best way to handle a splice with a leak is to cut out entirely and put in new piece, allowing about two to three inches on each end for lap, if using air drying cement, and about one to two inches if curing method is used.
4. Buff the ends of the connecting side of the tube and splice.
5. Wash with high-test gasoline and coat with cement. If using patching cement apply two coats, allowing each to dry.
6. When cement is dry pull the end over to connect, taking care to fit the inside snug, as the success of your splice is the start of the connection, the rest being mechanical.
7. Now add a small amount of air in the tube to give body and pull the ends over completely. Roll well and hang up to set.
8. When curing a splice use the vulcanizing cement and connect as you would the one above, and before pulling the ends over wrap a thin layer of tube gum around the tube and then pull down. Cure on the plate like you would a hole repair, by turning the tube after each cure.
9. When you have made your connection of the splice and same has set or been cured, apply to the emery stone and grind the edges down to a feather-edge. This can be done in a workmanlike condition with a little practice and is much easier than trying to grind down before making the splice.
10. Acid cure splices must be made quickly as the acid sets the patching cement in about one minute. The acid cure splice, however, is being discontinued and almost all factories are curing their splices.

SINGLE TUBE BICYCLE TIRES:

1. Remove rubber around the tire 1 1-2-inch each side of injury.
2. About 1-4-inch in remove one ply of fabric from the tire.
3. Buff lightly the fabric and ends of rubber.
4. Trim the edges of injury and remove dirt from inside of tire.
5. Clean the inner wall of tire with benzine.
6. Apply cement both inside and outside.
7. Cut a piece of backing about twice the size of the hole and insert.
8. Fill the injury with tube gum or cushion.
9. Inflate tire slightly to give round shape.

10. Cover and fit in bead fabric, cut on bias and bring around so it will overlap all around the tire.
11. Fit in another ply of bead fabric to rubber edges and lap around the tire.
12. Cover with tread gum.
13. Roll and stitch well.
14. Inflate to riding pressure after placing in the bicycle mould and cure about thirty minutes at fifty pounds.

CHAPTER XI.

SET-UP AND STEAM

We have now reached the most important part of the tire repairman's work, that of vulcanizing the raw gums in the repair jobs. A good steam-man can make a good looking repair in many cases out of a poor build-up and, on the other hand, can spoil good repairs through carelessness, or ignorance of his plant or steam requirements. The steam-man must be capable of handling his plant to the extent of locating any difficulty in securing sufficient heat, complete circulation and to keep it at a required temperature. He must also know the stock in the repair and the time it takes to cure it to a satisfactory degree.

When the tire comes to the steam-man he should judge instantly the size of bag needed, the size mould and the kind of set-up he will make.

THE AIR BAG:

1. Air bags are now supplied by many manufacturers, in various lengths and sizes to suit the needs of the repairman. In most cases the manufacturer will state as to whether or not water should be placed in the air bags. We believe that the manufacturer's decision should be followed in this matter as he would be in a position to know the composition of the bag and if it would stand water.
2. The purpose of the air bag is for supplying pressure against the inside of the tire when in the mould and which pressure forces the raw gum, when heated, to a solid unit.
3. Never use an air bag as a building form.
4. Never pull bags out of the tire by the hose or bend them sharply when sticking. Work them loose gradually, should they stick.
5. Always keep enough air in the bag to hold its shape at all times and hang up with a cord on the wall when not using.
6. When inflating air bags in the tire in the mould, fill with fifty pounds of air for most of the smaller sizes. Should you have

5-inch to 6-inch tires, this pressure should be increased about ten pounds.

7. As the air bag is not capable of any great amount of expansion without damage to the bag, it is necessary to pad the bag with plies of fabric of various thicknessess. These can be made from old casings.
8. When taking the tire out of the mould, always be sure to let the air out.

THE IMPRESSION PAD: Is used for retaining the non-skid feature on tires or for reprinting the feature on tread sections, etc. On tires on which the non-skid is not being replaced, soapstone can be used to fill with and good work can be obtained. However, there is no pressure obtained by the use of soapstone and for this reason the pad is found to be the best.

1. Pads are made to fit moulds of 1-4 and 1-5 circle and are usually 26 inches long and 30 inches long.
2. When taking the first impression on the pad, lay it in the mould and heat slightly before setting the tire on for the imprint. In fact the inprinted pad should be always heated before applying, so it will shape easily.
3. In curing a pad for imprint, lock up your tire as you would for a regular cure, taking care to soapstone the tire and cure about fifty minutes at fifty pounds pressure.
4. When applying the pad on the tire for cure, it can be tied on or secured by applying patching cement, which has been found to be the most practical. This will adhere where it is set and will not slip. The patching cement under heat becomes soft and the pad is pulled away easily. Do not get the cement on raw gum, however.
5. When making an impression pad make it right. Take two pieces of fabric or bareback fabric of the proper length and width, place on these two layers of 1-16-inch tread gum or more, if the non-skid is deep, and then cure. You will have a strong non-chipable pad that will cure seventy-five cures or more without loosing the impression.
6. Impression pads are expensive when made for a single impression, a 4-inch pad costing between $1.25 and $1.40 to make.

THE SET-UP FOR CURE:

1. When the tire comes to the steam man he should lay it on the bench and dust the inside and outside with soapstone to prevent sticking of the metal or bag.
2. Select the proper sized bag which is the same size as the tire and fit in the tire; if loose, pad to make same snug.
3. Select the proper bead mould and fit the tire to the bead mould, after same is dusted with soapstone, the sizes being optional to the way the sizes run in the moulds. On straight side tires the bead moulds can be dropped in over the tire in the mould after the tire is set.
4. Set your tire up on shelf. If a plain tread, take narrow strips of cloth, wet and cover the places with raw gum. Cover the whole tread with a cloth to prevent marking and burning.

   If a non-skid tire, cover the raw gum with strips of wet cloth and then either fill the non-skid indenture with wet soapstone or apply the impression pad. It the soapstone is used, cover with cloth over the whole tread to hold the soapstone.
5. If you have been using the Q. D. bead moulds, the hand clamp is used to hold the sides together.
6. Dust the mould with soapstone and insert the tire and bead moulds, using a rubber hammer to pound the bead moulds tightly into place.
7. Tighten up the mould clamp good and tight and add air to your bag at fifty pounds pressure. Then loosen the mould clamp slightly to relieve the bag and feel it up again to see if set. Cure to the scale.

SET-UP FOR RETREAD:

There are many different methods of setting up a retread for cure in the kettle, all of which have good points; the main thing, however, is to remember that pressure must be obtained on the tread that is being cured on.

1. One method is to use a rim or ring with an endless air bag.
2. With rim and retread coils.
3. With retread coils only and a small ring to hold the shape of tire.

   Any of the above ways can be used.
4. Take the tire from the building bench and fill up the ribs or the non-skid feature with soapstone, rounding same on the tire.

5. Cover with a cloth to hold the soapstone. This is after the coil or bag has been placed in the tire.
6. If you are using the air bag and rim, it can be inflated at once. However, most shops merely use the coil and ring or sometimes only the coil in which case the beads must be forced together with pressure as the wrapping is done. When you use the coil it is good policy to place a fabric reliner or old tube in the case to stop the ridging or marking of the inside of the tire.
7. Now wrap the entire tire with two layers of wet muslin, cut in strips about four inches wide, using all the pressure you possibly can and at the same time keeping it even.
8. If you are only using the coil, slip a metal ring inside the tire to hold it up to shape in the kettle and you are ready to cure to the scale.

General Information on Steam, Etc.:

1. Repairs on large casings should be cured on the arm after coming out of the mould. If not followed, failure sometimes occurs.
2. Blow out your steam line occasionally and you will stop erratic cures. This can be done with your air line.
3. Whenever a tire shows signs of blistering, it is a sign of insufficient pressure. The same applies to porous spots.
4. Clean your moulds every day with emery cloth and wash with soft soap and water.
5. By using a shorter air bag than the mould you will stop ridging or marking your tires.
6. Steam leaks in a line can sometimes be stopped by putting four or five spoonfuls of corn meal into the boiler.
7. Temperature does the curing, not the pressure on the gauge.
8. Aim to have complete circulation.
9. Put pet cocks on all your moulds, etc., to let out pocketed air and release water clogging under vacuum.
10. Use the thermometer on your plant.
11. Non-skids can be retained by wet soapstone or pads.
12. To get pressure on raw rim, in low place, fill up with wet cloth.
13. Always cover the tread with a wet cloth to prevent burning.

14. It is a good point to use a bead spacer for the curing of the oversize tire. This is done by using the regular bead mould of the undersize in the oversize mould, the bead spacer taking up the additional space.
15. If a tire shows signs of blowing when coming out of the mould, immerse in water.

CURING SCALE:

For the benefit of the repairman, the following scale showing the steam pressure equivalent in degrees to Fahrenheit is given.

Steam Pressure	Degree Heat Fahrenheit	
35 lbs.	280.6	The time of cure will fluctuate by difference in heat. Aim to work at 50 to 55 lbs. pressure.
40 lbs.	286.7	
45 lbs.	292.4	
50 lbs.	298.7	
55 lbs.	302.6	
60 lbs.	307.3	
65 lbs.	311.8	

The above scale is approximately correct when circulation is entirely open.

CURING SCALES:

The time of cure of the different repairs is in many cases optional with the repair steam-man, due to the many makes of vulcanizing plants on the market and also to kinds of materials used. It is always advisable for the steam-man to take test cures and arrive at curing scales for himself. In fact this is simple, as the different jobs as they come out can be tested with a pencil point and if the impression remains and does not come back to place, a slight amount more of curing will remedy it. Should it be hard or brittle, decrease the cure. The following scales have been derived at a large plant using controlled steam at fifty to fifty-five pounds pressure on standard equipment and can safely be used in any plant with this same amount of steam with the best of results, a slight variation to be made to suit the plant in use.

FABRIC, CORD, AND CORD FABRIC SECTIONAL REPAIRS.

Size	Fabric	Silvertown Cable Cord	Cord Fabric
3 inches	45 min.	50 min.	50 min.
3½ inches	50 min.	60 min.	60 min.
4 inches	55 min.	70 min.	65 min.
4½ inches	60 min.	80 min.	70 min.
5 inches	60 min.	80 min.	70 min.
5½ inches	65 min.	90 min.	75 min.
6 inches	70 min.	90 min.	80 min.

When using an impression pad add 10 to 15 minutes.

Cure a fabric tire on the arm about 1 hour. Cord tire 1 hour 15 minutes.

Cure fabric tread sections and tread patches 10 minutes less than section.

Cord tread sections and tread patches 15 minutes less than section.

RETREAD CURING TIME (in Kettle).

Fabric Tire with Raw Gum	Fabric Tire with Band	Cable Cord with Band
Take 15 min. to bring up to 55 lbs. Then cure 45 min.	Take 30 min to bring up to 55 lbs. Then cure 45 min.	Take 30 min. to bring up to 55 lbs. Then cure 50 min.

Gum will flow at 5 lbs. steam pressure. The time used bringing the heat up is to flow the gum or cushion properly and the curing time is for setting and pressure.

TUBES.

Cure gray tube for hole repairs 15 to 20 minutes at 50 lbs.

Cure red tubes slightly less than gray tubes.

Splices and valve pads take about the same time.

CHAPTER XII.

EQUIPMENT.

The selection of equipment for the repairman depends greatly on manner in which he learned the trade. The novice or beginner should order his equipment as near standard as possible for turning out work quickly and of neat appearance. It is not our purpose to recommend any special equipment, as a call at any large tire branch will enable the workman to find out the kind most in demand. However, whatever is installed should be of the best quality.

There are two distinct kinds of mould equipment in use, the air bag system and the block system. The air bag system takes a set of metal bead moulds or forms to case the bag in the tube when inflated and cures the entire repair at one cure. The block system consists of moulds and a wooden or rubber block, reinforced in many cases with metal, which is used for applying pressure to the parts of a repair. Under the block system it takes two or more cures to take care of a sectional repair. On tread spots and patches the blocks, however, do some good work.

We are listing below and describing the equipment found in a shop of large side. The information is given more to explain the uses of the different parts and how they are handled.

The Boiler: Boilers are of different sizes and styles, according to the amount of steam pressure required for the size of the shop. A large boiler from four to eight horse power is best operated by coal or gas, and the position of the boiler, in regard to the drain line, designates the kind of system the plant operates under. When you can, place your boiler in the basement of the building or below the drain line of your moulds. Then you can have a gravity system on which you connect your outgoing steam line at the top of your boiler, bringing the return in at the base. With this system, city gas with a controller is preferable, due to the fact that you have very little waste water and therefore do not require so much heat after you once get steam up. This also requires very little attention.

When you have to place your boiler on the floor where your water level in the boiler is above the drain line, a non-return system

is required with an outgoing steam line which is the only connection to the boiler. Here you use the trap on the end of the drain line, and while this water can be pumped back into the boiler, it is seldom done, more usually draining into the sewer. You are, therefore, heating cold water all the time when filling the boiler and, especially in a large plant, a coal boiler is recommended.

Coil Boiler: The coil boiler is a small steam generating boiler, usually used where the equipment is placed on a stand. It is a straight gravity system boiler, due to the fact that it is not large enough to waste water and condensation through the trap. It can be heated by gasoline with a force feed system or by city gas.

Gas Burner: The gas burner is used both in heating large boilers, coil boilers and small unit block moulds or single cavity moulds.

The Moulds: The moulds are metal blocks of horse-shoe shape, made to fit the tire, and having a hollow interior for circulation of steam for heating the mould. Any and all heat throughout the cure of the tire comes from this block. Different manufacturers have different arrangement for the mould blocks. They can be secured singly or in blocks of one or more cavities, this being optional as to the requipment or the repairman. The arrangement of sizes in the moulds is a matter of considerable interest, due to the size tires that the cavity would cure. Some makers of equipment makes moulds to take two sizes of tires in the cross section. The actual measurement of the cavity designates what tires it would cure properly, for instance a mould measuring 3¾ inches would take two sizes, namely, a 3½ and 4 inch tire, while if it measured 3¼ inches it would take a 3 and 3½ inch tire. If, however, it measured exactly 3½ inches, it would be a single tire cavity, this being the way that some moulds are made.

The moulds are connected up singly or in blocks with the boiler with the steam coming in at the top sides of the mould and passing out through the drain or return at the bottom, in this way giving a drainage to the condensation.

Many ways are in use for clamping the bead moulds in the tire, some using a hand clamp which fastens under the mould and down on the bead moulds, while others have devices fastened on the moulds proper, for direct downward pressure.

The Bead Mould: The bead moulds usually consist of two sides of machined metal, grooved to fit the tire beads and which lock

over the beads when setting up the tire. The bead moulds run sizes similar to the sizes of the moulds and the proper bead mould can easily be found by measuring, as you would the mould, to see what tire it would take, providing it was not marked.

BEAD SPACERS: Bead spacers are not generally used, however, the exacting repairman will take advantage of the same. It enables the smaller size bead mould to fit into the oversize cavity and at the same time obtain the same bead curvature.

INSIDE ARM: The inside curing arm is useful in any shop for curing inside repairing on tires. For good work, large size tires with sectional work should be placed on the arm for inside curing after coming out of the mould. The arm is made in various sizes and styles.

SIDE WALL VULCANIZER OR ARM: Used for curing rim cuts and side wall repairs. Gives pressure to tire by bolt tightening device, and is a saving of the air bag. Made in various sizes and styles.

THE REDUCING SHELL: Placed in mould cavities for the purpose of repairing small size tires. Made in various sizes and styles. Useful in any shop.

BUFFER AND BRUSHES: Used for cleaning, roughing and buffing tires and tubes. Consists of shaft, pulley and base for putting eight to ten inch wire brushes on, usually speeded up from 1,800 to 2,400 revolutions per minute.

THE GRINDER: Holds the emery stone, used in grinding splices and general work around the shop.

PUMP, AIR TANK AND PIPING: Necessary for supplying air to the mould bench, for testing tubes, and general service.

TESTING TANK: For all tube testing and cooling purposes.

TIRE ROLLER: Hand operated roller for uniting sectional repairs, tread repairs, etc., under pressure.

PRESSURE GAUGE: For indicating steam pressure on steam line and boiler.

THERMOMETER: For indicating temperature of the line or moulds.

FORCE FEED SYSTEMS: A gasoline tank with pump attachment for forcing gasoline to gasoline burners. Used on coil boilers, etc.

BLOCKS AND CORES: A set of metal blocks grooved to fit tires for patch and spot work. Saves air bags and is placed on the tube plate.

Rotary Rasp: A circular rasp used on the buffing spindle for tearing old treads off tires, and general work.

Motor: Used in operating the pump and buffer with the grinder. Where the buffer only is run a 2-H. P. motor will be sufficient. When the pump and buffer are operated a 3 or 3½-H. P. motor should be used.

The Tube Plate: A flat, hollow, metal block for vulcanizing tube repairs and equipped with either hand clamp, weighted clamps or spring clamps for applying pressure on the tube when curing. Made in different sizes and styles.

The Retread Kettle: For repair shops two types are in use. The small kettle has a weighted top and is of a doughnut construction. Cures from two to four tires, with a small boiler, such as a coil boiler or larger.

The larger kettle usually has a hinged, sealed door in which ten to twelve tires can be cured. This requires a four-horse power, or larger boiler.

The Retread Mould: Similar to the sectional mould, except that it is made in one-third circle of a tire. Blocks of rubber made to fit the tires are usually used for pressure with clamps.

Trap: A device used on non-return steam systems to allow for the escape of water from the steam pipe. When the trap fills with water it empties itself automatically without loss of steam. Will force water about twice as many feet as the pounds pressure of steam on the line. Made in different styles.

Gas Controller: A valve device for use on gas boilers, being connected to the steam line or boiler by a pipe which automatically shuts off the gas to a certain degree when required pressure is obtained.

Force Feed Pumps: Usually hand operated to force water into the boilers against the steam pressure.

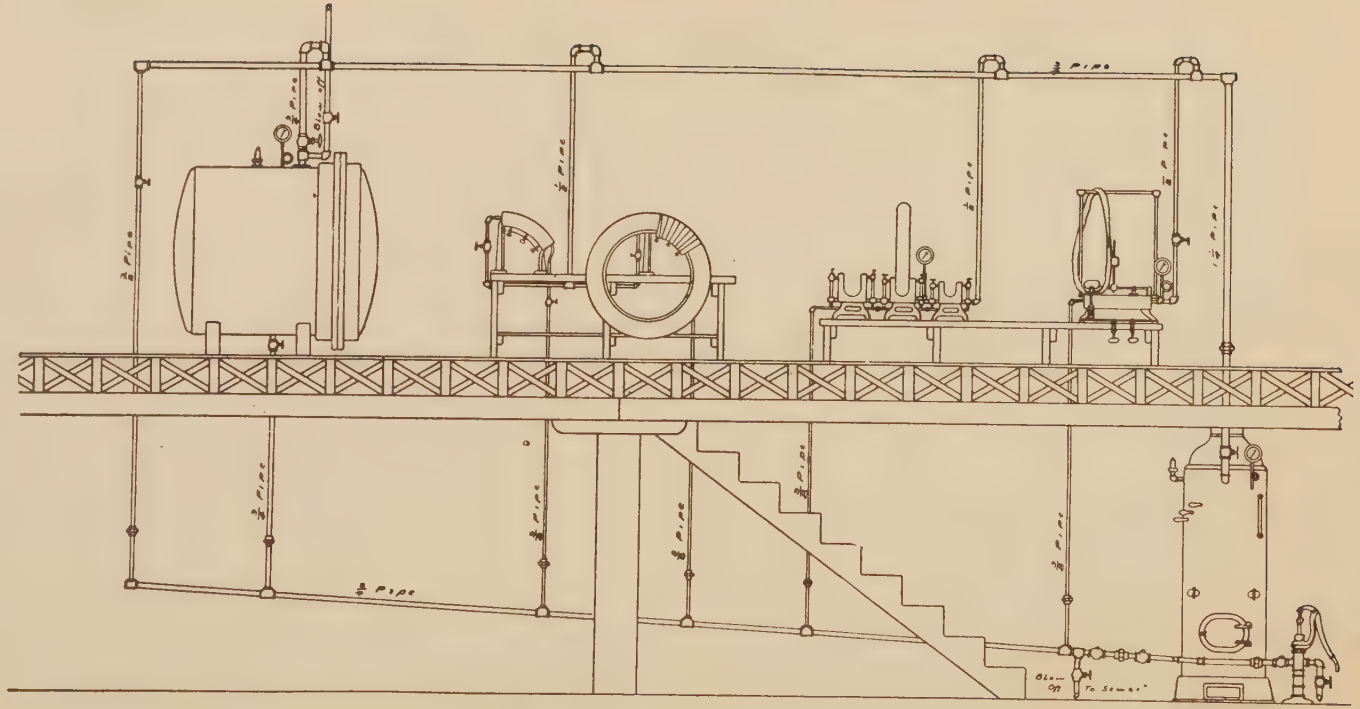
Retread Coils: A spiral spring, used for placing inside tires when retreading, for obtaining pressure. Made in various sizes.

Retread Endless Air Bag: A special wrapped rubber tube for inflating tires when retreading, made in various sizes.

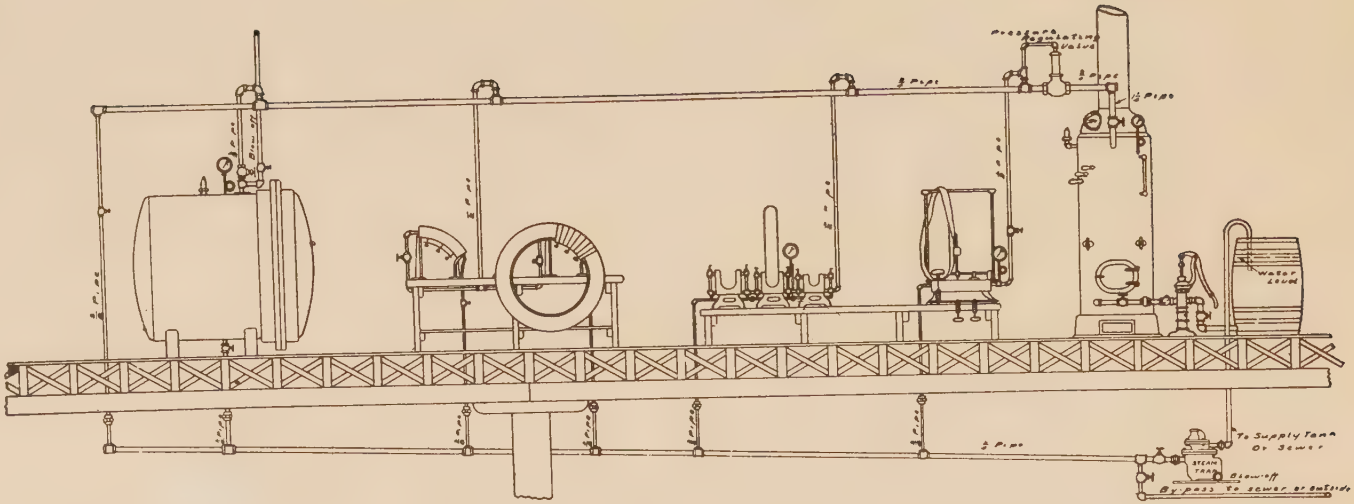
Retread Rims: A special rim made for placing tires on for retreading. Usually bolted together.

Retread Rings: Used for the same purpose as the rim, only that a special clamp is used for connection until after the tire is wrapped.

Building Mandrels: Steel core made in various sizes to place tires on when rebuilding.



Boiler arrangement for Gravity System.



Boiler arrangement for Non-Return System using Trap.

MANUFACTURERS OF SHOP VULCANIZING EQUIPMENT.

Acme Supply Co. .....Iona, Michigan
Adamson Mfg. Co. .....East Palestine, Ohio
Anderson Steam Vulcanizer Co. .....Worthington, Indiania
Arthur Vulcanizing Mch. Co. .....Warren, Ohio
Auto Tire Vulcanizing Co. .....Lowell, Massachusetts
Akron Rubber Mould & Mch. Co. ....Akron, Ohio
Battle Creek Vulcanizing Co. .....Battle Creek, Michigan
Briggs Boiler Works Co. .....East Akron, Ohio
Champion, F. M. .....Utica, New York
Craft Vulcanizing Co. .....St. Paul, Minnesota
Diamond Mfg. Co. .....Des Moines, Iowa
Gilliland Mfg. & Supply Co. D. C. ....St. Louis Missouri
H. &. H. Mfg. Co. .....LaFayette, Indiania
Haywood Tire & Equipment Co. .....Indianapolis, M. A. C.
Hill Stage Co. .....Anderson, Indiania
Mapes-Lee Co. .....Rochester, New York
Miller, Chas. E., Rubber Works .....Anderson, Indiania
Milwaukee Auto Specialty Co. .....Milwaukee, Wisconsin
National Motor Supply Co. .....Painsville, Ohio
Progressive Mfg. Co. .....Milwaukee, Wisconsin
Shaler Co., C. A. .....Waupun, Wisconsin
Star Vulcanizing Co. .....Columbus, Ohio
Superior Vulcanizing Co. .....Rochester, New York
Tire Repair Equipment Co. .....Appleton, Wisconsin
Vanderpool Co. .....Springfield, Ohio
Wheeling Stove Vulcanizing Co. .....Wheeling, West Virginia
Williams Foundry & Mch. Co. .....Akron, Ohio

CHAPTER XIII.

REQUIREMENTS AND ACCOUNTING.

The repairman, when starting in for himself, should have some idea of the equipment, tools, materials, etc., that he will require in the shop. In many cases it is hard to secure a complete list of the requirements. As equipment may be ordered off-hand, usually some important item is overlooked. The writer has ordered and installed several shop equipments and believes the following list will be useful in arranging to equip a shop of medium size, in a town away from direct touch with factory branches. The repairman, away from the factory branch, in a small town has to carry almost as much stock as the large city shop, due to the fact that the city shop can run to the different branches and buy as needed, while the man in the country must order enough ahead to be sure of delivery. Should a larger shop equipment be required than the one listed, it is only a matter of adding more moulds, more bead moulds, bags, and perhaps a larger boiler and a kettle, if used with the necessary retreading items.

EQUIPMENT REQUIRED.

MOULDS: Sufficient to cure tires 2½ to 5 inches. These moulds may be in block or single. If in block, be sure to have the boiler attachment with gauges, piping, etc. If single, a coil boiler or larger should be ordered with the necessary burners, controller, or force feed system, piping, gauges, etc.

BEAD MOULDS: Sufficient to cure the required S. S. and Q. D. tires in each mould.

SHELL: To reduce your largest mould to the medium size, giving you double capacity in this size, usually a 4½ and 5-inch mould to fit a 3½ and 4-inch mould.

TUBE PLATE: A tube plate of 4 or 6 clamps will do, with gauge.

INSIDE ARM: One 3, 3½ and 4-inch arm usually will take most of the work. A 4½ and 4-inch arm should be added if possible.

BUILDING MANDRELS: A set complete to build 2½ to 5-inch tires.

ROLLER: A roller is essential, although some repair shops do not use it.

BUFFING STAND COMPLETE: This should be equipped with one 8 or 102 brush and one fine carborundum stone, with necessary shafting, belt, etc.

TESTING TANK: About thirty-seven inches in diameter and twelve inches deep, with drainage.

AIR PUMP: Capable of pumping 150 pounds pressure, with belt, pulley, etc.

AIR TANK: Of sufficient size for your business, with piping, valves, etc.

MOTOR: About 3 to 3½ horse power for excellent work; belt, etc.

AIR BAGS: Sufficient to take care of 2½ to 4-inch tires.

HAND CLAMP: For clamping bead moulds.

VISE: For general shop work.

TOOLS:

A pair of carpenter's pinchers for pulling fabric.
Awl for loosening fabric.
Knife files for beading fabric knife.
2 6-inch rubber knives for cutting and trimming.
1 4-inch layback knife.
1 Sand-stone for sharpening knives.
1 4-inch cement brush for cementing.
1 2x2 roller.
1 Corrugated stitcher.
1 Punching awl.
1 Tread gauge.
1 Rasp.
1 Pair large shears.
1 Rule.
1 Wire brush.
Nut wrenches for valve nuts.
2 or 3 small brushes for tube work.
1 Pair curved shears.
1 Pair 4-inch plugging pliers.
1 Screw driver.
1 Star valve wrench.
1 Punch.
1 Flat file.

1 Machinist hammer.
2 Changing tools.
1 Large screw driver.
1 Jack.
1 Foot pump.
Wood stretchers should be made for inside work on tires.
Hanging racks for drying tires should be provided.
Gasoline and water cans should be provided.

Lumber sufficient to make the following benches, as building-bench, cutting-down bench, tube-bench and tire racks.

Repair Stocks:

Ten pounds each of side wall gums in three colors, 1-16-inch.

Fabric F2 C1	25 to 50 pounds
Bareback	15 to 20 pounds
Bead cover	5 pounds
Breaker	5 pounds
Cushion, 1-32	10 to 15 pounds
Reliners, a few good sizes.	
Tube filler gum	10 pounds
Tube backing gum	15 pounds
Cement	5 to 10 gal.

A quanity of valve pads, patching cement, caps, and other important accessories should be stocked for service.

If you do cord work, purchase a sufficient quantity of cord fabric, and other cord materials as shown under repair fabrics, gums, etc.

ACCOUNTING.

In connection with having a first class line of equipment, and knowing the tire repair trade, it is necessary for the owner of the repair shop to adopt some inexpensive system of accounting and order in which the work is done, so that he has a record of every repair going through the shop and can trace it quickly, should occasion arise. This system should work in with the office books for the charging of accounts. No records should be thrown away or destroyed at any time.

The following system will be found to work automatically and prove efficient for any size repair shop:

THE REPAIR TAG: The repair tag is very important, being used for identification of the work, showing work done, and the charges estimated or made. This tag should be numbered consecutively in quantities to suit the amount of business during the busy season.

Rerforate Here ☞

O

NAME OF THE REPAIR-SHOP.

No. .....

.....

No. .....

Date Received .....

Case .....

Tube .....

NAME .....

Address .....

Order No. .....

Instructions: .....

.....

.....

Total Charges .....

Billed Invoice No. .....

SPECIMEN OF REPAIR TAG.

The repair tag should never leave the shop under any circumstances, and all information, such as On Rim, On Wheel, Cover to Go, Time to be Ready, etc., should be listed on the job when received. Always tie the tag on the tire or tube, never to the rim, cover, etc., as a dummy identification tag should be used for this purpose.

THE DUMMY TAG: Purchase a quanity of blank tags, tinted lightly so as to take pencil, size about 1⅝ by 3½ inches, and use

these tags for attaching to the rims, covers or tire tube on which no work is to be done, but which must be held for set-up. On this tag put the customer's name and the number of the repair tag on which work is being done. This will enable you to immediately assemble a complete set-up without error, should a customer have many different jobs at one time.

This dummy tag is also used as a rush tag; that is, if you have a job that should be done at a certain time, slip a colored dummy tag on the string when tying the repair tag on. The colored tag will always show up when lying around and you will know that the job requires attention before others.

THE BLOTTER: In connection with the repair tag, in large shops, a blotter should be used to list all jobs on when coming into the shop. A large ruled book will do in many cases and will last indefinitely. The numbers should be arranged consecutively, like the tags, and the articles worked on marked in its place, with the customer's name, order number and information as to being on rim, etc., noted.

Tag No.	Case	Tube	Name	Order No.	Remarks
1.	34 x 4		John Smith	248	On rim. Today

SPECIMEN OF BLOTTER.

The blotter will be found very efficient in all cases of checking off tags as they come into the office, in this way bringing the rush work to your attention in the day's work and also in checking back for sizes, etc., after you have filed the tag. In many cases a customer

pays cash and you have no direct records of his individual tag, but knowing about the time he was in, you can run over your blotter and locate his name, get the tag number and then find the tag for the work he had done. In all charge accounts the number of the tag should appear on the invoice.

The Invoice: Pads of invoices should be provided, numbered consecutively and made in duplicate. These can be for typewriter billing or pencil use. The purpose of the invoice is to list the charges for the individual customer, either daily or monthly, as the case may be. One or more tags can be listed to the invoice. The original is given the customer or mailed to him and the duplicate is usually filed in the number order on a file, the invoices for the month being kept together after they are posted to the customer's ledger.

A quantity of invoices should be ordered with blank number for the purpose of forwarding duplicate invoices, should same be provided.

A credit memo should also be provided, same as the above invoices in duplicate only, printed in red and noted as CREDIT.

From these invoices you can post the total of the invoice to your ledger under the customer's name and list the invoice number and date. Only in this way have you a direct check for every item charged or credited to the customer.

In large shops, a complete accounting system can be installed with the required books, such as cash book, customer's ledger, creditor's ledger, journal (special column), general ledger, etc., however, the average shop does not require such an elaborate system.

A quantity of shipping tags, both outgoing and incoming should be provided for out of town business and shipments.

TEL. NO. 6666

INVOICE NO._____

NAME OF REPAIR SHOP

NAME OF PROPRIETOR

WITH THE ADDRESS HERE

TIRE ACCESSORIES, VULCANIZING
TIRE AND TUBES, RETREADING

SOLD TO_____ DATE_____

TOWN_____ ORDERED BY_____

TERMS_____ ALL WORK STRICTLY GUARANTEED

TAG NO. YOUR ORDER

SPECIMEN OF INVOICE—Full size 8½x11

CHAPTER XIV.

ACTUAL COST OF DOING FABRIC AND CORD TIRE REPAIRS.

COST ACCOUNTED JANUARY 1st, 1918.

These costs are derived from actual weight, prices and wage scales in force January 1st, 1918, and are based on materials as listed below, quotations being taken from invoices on which the material was purchased. All costs are based on the standard 8-inch section.

LABOR.

The labor is derived from the average wage of a skilled repairman, working for a salary of $25.00 per week, $4.15 per day, 50 cents per hour.

The unoccupied time is pro-rated in this way, leaving no additional charges or cost to be added outside of that covered by over-head expense.

MATERIAL.

The material is the actual invoice cost, less 5% cash discount.

Material	Thickness	Cost per lb.	Cost per ounce
Cushion	1/32	$0.85	$0.05 1/2
Fabric	F2 C1	.83	.05 1/6
Bareback	F1	.85	.05 1/3
Sidewall	1/16	.70	.04 1/2
Tread Gum	1/16	.68	.04 1/2
Cement	....	1.85 gal.	.23 pt.
Tube Gum	....	.68	.04 1/4
Comb Gum	....	.84	.05 1/4
Reliners	....	....	....
Breaker	....	.84	.05 1/4
CORD MATERIALS—			
Tread Gum	1/16	.68	.04 1/2
Tread Gum	1/16	.84	.05 1/4
Side Wall	1/16	.90	.05 1/2
Cushion	1/64	1.33	.08 1/3
Cords, any size	....	.35	.02
Retread Bands as shown	....	....	....
Staples, No. 2, 480 to lb.	....	1.00	....
Staples, No. 4, 320 to lb.	....	1.50	....
Chaffing Strip	....	1.30	.08
Palmer Cord Fabric	....	1.29	.08

DETAIL COSTS.

FABRIC RETREAD.

Gum or Camel Back, Breaker added.

Operation	30 x 3 Qt.	30 x 3 Amt.	30 x 3½ Qt.	30 x 3½ Amt.	32 x 3½ Qt.	32 x 3½ Amt.	34 x 4 Qt.	34 x 4 Amt.	35 x 4½ Qt.	35 x 4½ Amt.	36 x 4½ Qt.	36 x 4½ Amt.	37 x 5 Qt.	37 x 5 Amt.
Cutting	25m	$0.21	30	$0.25	30	$0.25	30	$0.25	40	$0.34	40	$0.34	40	$0.34
Buffing	20m	.17	20	.17	20	.17	20	.17	20	.17	20	.17	20	.17
Cement	¾ q	.35	¾ q	.35	1	.46	1	.46	1¼	.58	1¼	.58	1¼	.58
Cementing	15m	.12	15	.12	15	.12	15	.12	15	.12	15	.12	15	.12
Cushion 1 / 32	9 o	.48	11	.59	12	.64	16	.85	17	.91	19	1.01	20	1.07
Tread Gum CB	3 / 3	2.29	⅜	2.52	3¾	2.70	5 / 2	3.49	6 / 9	4.72	6¾	4.86	8 / 7	6.07
Building	45m	.37	45	.37	50	.42	60	.50	60	.50	60	.50	60	.50
Wrapping	30m	.25	30	.25	45	.37	45	.37	45	.37	45	.37	45	.37
Total Cost		$4.24		$4.62		$5.13		$6.21		$7.71		$7.92		$9.22
Breaker to be added	7 o	.37	8	.42	8½	.47	10½	.58	12½	.69	14	.77	14½	.80

FABRIC RETREAD.

With Ribbed or Giant Cord Semi-Cured Band.

Operation	32 x 3½ Qt.	32 x 3½ Amt.	32 x 4 Qt.	32 x 4 Amt.	34 x 4 Qt.	34 x 4 Amt.	36 x 4½ Qt.	36 x 4½ Amt.	37 x 5 Qt.	37 x 5 Amt.
Cutting	30m	$0.25	30	$0.25	30	$0.25	40	$0.34	40	$0.34
Buffing	20m	.17	20	.17	20	.17	20	.17	20	.17
Cement	¾ q	.35	1	.46	1	.46	1¼	.58	1¼	.58
Cementing	15m	.12	15	.12	15	.12	15	.12	15	.12
Cushion 1 / 32	12 o	.63	14	.75	16	.85	19	1.02	20	1.07
Tread Band		4.80		5.32		5.60		6.85		8.00
Building	50m	.42	60	.50	60	.50	60	.50	60	.50
Wrapping	45m	.38	45	.38	45	.38	45	.38	45	.38
Total Cost		$7.12		$7.95		$8.33		$9.96		$11.16

NOTE: In the same width retread one additional inch in length costs 21c.
In the same length retread one additional inch in width costs 40c.

COMPLETE SECTION 8-INCH LAYBACK.

Operation	3-inch		3½-inch		4-inch		4½-inch		5-inch	
	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.
Cutting	25m	$0.21	30	$0.25	30	$0.25	35	$0.29	35	$0.29
Buffing	10m	.08	15	.13	15	.13	15	.13	15	.13
Cementing	10m	.08	10	.08	10	.08	10	.08	10	.08
Cement	pt.	.24	pt.	.24	pt.	.24	pt.	.24	pt.	.24
Building	30m	.25	30	.25	30	.25	35	.29	40	.33
Cushion	1¼ o	.06	1½	.08	1½	.08	2	.11	2½	.13
Fabric	8 o	.41	9	.47	10	.55	15	.78	19	.99
Bareback	2 o	.11	2	.11	2	.11	2½	.13	3	.16
Side Wall	2 o	.09	2¼	.11	2½	.11	3	.14	3½	.16
Tread Gum	2½ o	.12	2½	.12	2½	.12	3	.14	4	.18
Set up	15m	.13	15	.13	15	.13	15	.13	15	.13
Total Cost		$1.78		$1.97		$2.05		$2.46		$2.82

INSIDE SECTION 8-INCH.

Operation	3-inch		3½-inch		4-inch		4½-inch		5-inch	
	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.
Cutting	20m	$0.17	20	$0.17	20	$0.17	20	$0.17	20	$0.17
Buffing	10m	.08	10	.08	10	.08	10	.08	10	.08
Cementing	5m	.04	5	.04	5	.04	5	.04	5	.04
Cement	½ p	.11	¼	.11	¼	.11	¼	.11	¼	.11
Building	25m	.21	25	.21	25	.21	30	.25	30	.25
Cushion	¼ o	.02	¼	.02	½	.03	¾	.04	1	.06
Fabric	6½ o	.34	7½	.39	8¼	.44	13½	.17	17½	.90
Bareback	2 o	.11	2	.11	2	.11	2½	.13	3	.16
Tread Gum	2½ o	.12	2½	.12	2½	.12	3	.14	4	.18
Set up	15m	.12	15	.12	15	.12	15	.12	15	.12
Total Cost		$1.32		$1.36		$1.43		$1.78		$2.07

SIDE SECTION 8-INCH LAYBACK.

Operation	3-inch		3½-inch		4-inch		4½-inch		5-inch	
	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.
Cutting	30m	$0.25	30	$0.25	30	$0.25	35	$0.29	35	$0.29
Buffing	10m	.08	15	.13	15	.13	15	.13	15	.13
Cementing	10m	.08	10	.08	10	.08	10	.08	10	.08
Cement	pt.	.23	pt.	.23	pt.	.23	pt.	.23	pt.	.23
Building	30m	.25	30	.25	30	.25	35	.29	40	.34
Cushion	1¼ o	.06	1½	.07	1½	.07	2	.11	2½	.14
Fabric	4 o	.21	4½	.23	5	.26	9	.47	11	.57
Bareback	2 o	.11	2	.11	2	.11	2½	.13	3	.16
Sidewall	1 o	.05	1/1/8	.05	1¼	.06	1½	.07	1¾	.08
Tread Gum	2½ o	.12	2½	.12	2½	.12	3	.14	4	.18
Set up	15	.12	15	.12	15	.12	15	.12	15	.12
Total Cost		$1.56		$1.64		$1.68		$2.06		$2.32

TREAD SECTION 8-INCH.

Operation	3-inch		3½-inch		4-inch		4½-inch		5-inch	
	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.	Qt.	Amt.
Cutting	10 m	$0.08	10	$0.08	10	$0.08	10	$0.08	10	$0.08
Buffing	5 m	.04	5	.04	5	.04	5	.04	5	.04
Cementing	5 m	.04	5	.04	5	.04	5	.04	5	.04
Building	20 m	.17	20	.17	20	.17	20	.17	20	.17
Cement	¼ p	.06	¼	.06	¼	.06	¼	.06	¼	.06
Cushion	1¼ o	.06	1½	.07	1½	.07	2	.11	2½	.13
Fabric	2½ o	.13	2½	.13	3	.16	3	.16	3½	.18
Bareback	2 o	.11	2	.11	2	.11	2½	.13	3	.16
Tread Gum	8½ o	.38	9	.41	9	.41	9½	.43	10	.45
Set up	15m	.12	15	.12	15	.12	15	.12	15	.12
Total Cost		$1.09		$1.23		$1.26		$1.34		$1.42

Detail Costs of repair work to show the cost of the additional inch over an 8-inch section. Comparison is made on the 4-inch size for detail and footings shown for other sizes.

ALL 4-INCH SIZE.

	9-inch Section Complete Layback		9-inch Inside Section		9-inch Side Section Layback		9-inch Tread Section and Reinforced	
Cutting	30 m	$0.25	20	$0.17	30	$0.25	10	$0.08
Buffing	15 m	.13	10	.08	15	.13	5	.04
Cementing	10 m	.08	5	.04	10	.08	5	.04
Cement	pt.	.24	¼	.11	pt.	.23	¼	.06
Building	30 m	.25	25	.21	30	.25	20	.17
Cushion	1¾ o	.09	½	.03	2	.10	1¾	.10
Fabric	13 o	.69	10½	.54	7	.36	3¼	.17
Bareback	2½ o	.13	2½	.13	2¼	.13	2¼	.13
Sidewall	3 o	.14			1½	.07		
Tread Gum	2½ o	.12	2½	.12	2½	.12	9¾	.45
Set up	15 m	.13	15	.13	15	.12	15	.12
Total Cost 9-inch		$2.25*		$1.56*		$1.84		$1.36*

FOOTINGS OF DETAIL COST OF EACH SIZE.

	3-in.	3½-in.	4-in.	4½-in.	5-in.
9-inch Section Layback	$1.94	$2.15	$2.25*	$2.67	$3.05
9-inch Inside Section	1.43	1.49	1.56*	1.95	2.23
9-inch Side Section	1.72	1.81	1.84*	2.26	2.52
9-inch Tread Section	1.29	1.33	1.36*	1.44	1.53

RELINER CEMENTED IN.

	30 x 3	32 x 3½	34 x 4	35 x 4½	36 x 4½	37 x 5
Buffing	25m ... $0.21	25 ..... $0.21	25 ..... $0.21	25 ..... $0.21	25 ..... $0.21	25 ..... $0.21
Cementing	20m ... .35	20 ..... .35	20 ..... .35	20 ..... .35	20 ..... .35	20 ..... .35
Cement	pt. .... .46	pt. .... .46	1¼ ... .52	1½ ... .59	1½ ... .59	1½ ... .59
Inserting	30 ..... .25	30 ..... .25	30 ..... .25	30 ..... .25	30 ..... .25	30 ..... .25
Reliner	1.47	1.66	2.00	2.42	2.42	2.66
Total Cost	$2.74	$2.93	$3.33	$3.82	$3.82	$4.06

TREAD PATCH AND REINFORCEMENT.

	Tread Patch Only	Small Reinforcement	Large Reinforcement	Tread Patch and Small Reinforcement	Tread Patch and Large Reinforcement
Buffing	10 m $0.08	5 ..... $0.04	5 ..... $0.04	10 ..... $0.08	10 ..... $0.08
Cutting	10 m ..... .08	.....	.....	10 ..... .08	10 ..... .08
Cementing	5 m ..... .04	5 ..... .04	5 ..... .04	5 ..... .04	5 ..... .04
Cement	⅛ p ..... .03	1/16 .... .02	⅛ ..... .03	¼ ..... .06	¼ ..... .06
Building	15 m ..... .12	10 ..... .08	15 ..... .12	20 ..... .17	20 ..... .17
Cushion	½ o ..... .03	¼ ..... .02	¼ ..... .02	½ ..... .03	½ ..... .03
Tread	4 o ..... .18	.....	.....	4 ..... .18	4 ..... .18
Fabric Reinforced	.....	1 o ..... .05	5 ..... .26	1 ..... .05	5 ..... .26
Set up	15 ..... .12	15 ..... .12	15 ..... .12	15 ..... .12	15 ..... .12
Total Cost	$0.68	$0.37	$0.63	$0.81	$1.02

TUBE REPAIRS.

	Small Hole	Large Hole	X Large Hole	Pads	Valve	Splice
Repair Labor	4 m ..... .03	4 ..... $0.03	4 ..... $0.04	15 ..... $0.12	10 .... $0.08	30 ..... $0.25
Tube Gum	1/150 .001/7	1/5 ... .01	½ ..... .02	.....	.....	.....
Comb Gum	1/60 ...007/8	¼ .. .001/3	½ ..... .03	.....	.....	.....
Pad Cost	.....	.....	.....	.11	.....	.15
Valve Cost	.....	.....	.....	.....	.37½	.....
Change	5 m ..... .04	5 ..... .04	5 ..... .04	5 ..... .04	5 ..... .04	5 ..... .04
Total Cost	$0.08	$0.091/3	$0.13	$0.27	$0.49½	$0.44

NOTE: Fifty per cent of tubes brought in are on rim. Takes ten minutes average to break down and set, thus adding 5 min., 4c, to cost of each job.

CORD RETREAD.

	32 x 3½		32 x 4		34 x 4		36 x 4½		37 x 5	
Cutting	45m	$0.37	45	$0.37	45	$0.37	45	$0.37	45	$0.37
Buffing	30m	.25	30	.25	30	.25	30	.25	30	.25
Cement	¾	.35	1	.46	1	.46	1¼	.58	1½	.70
Cementing	15m	.12	15	.12	15	.12	15	.12	15	.12
Cushion	8 o	.67	8	.67	9	.75	10	.83	11	.91
Side Strip	10 o	.45	10	.45	11	.50	12	.54	12	.54
Band Cost		4.80		5.32		5.60		6.85		8.00
Building	80m	.67	80	.67	80	.67	85	.71	85	.71
Wrapping	45	.37	45	.37	45	.37	45	.37	45	.37
Total Cost		$8.05		$8.68		$9.09		$10.62		$11.97

CORD REPAIRS.

	3-inch Inner Cord Section Only		3-inch Outer Cord Section Only		3-inch Inner and Outer Cord Section		8-inch Cord Separation	
Cutting	30 m	$0.25	60 m	$0.50	60	$0.50	30	$0.25
Buffing	15 m	.13	30	.25	30	.25	15	.12
Cementing	10 m	.08	15	.12	15	.12	15	.12
Building	45 m	.37	60	.50	75	.62	30	.25
Cement	¼ p	.06	½	.12	½	.12	½	.12
Cords used	2¾ o	.07	3	.06	6½	.13		
Bead Fabric	3 o	.24	3	.24	3	.24	2	.16
Tread Gum			4	.18	4	.18		
Cushion	2 o	.17	3	.25	3	.25	1	.09
Set up	15 m	.12	15	.12	15	.12	15	.12
Total Cost		$1.50		$2.34		$2.53		$1.23

NOTE: The above cord costs were figured on all sizes in the cross width and the fluctuation was only about 1 to 2 cents.

8-INCH CORD TREAD SECTION.

	3½-inch		4-inch		4½-inch		5-inch	
Cutting	15 m	$0.12	15	$0.12	15	$0.12	15	$0.12
Buffing	5 m	.04	5	.04	5	.04	5	.04
Cementing	5 m	.04	5	.04	5	.04	5	.04
Building	20 m	.17	20	.17	20	.17	20	.17
Cement	¼ p	.06	¼	.06	¼	.06	¼	.06
Tread Gum	13 o	.57	14	.63	15	.68	16	.70
Cushion	½ o	.05	½	.05	½	.05	½	.05
Set up	15	.12	15	.12	15	.12	15	.12
Total Cost		$1.17		$1.23		$1.28		$1.30

CORD TREAD PATCH.

Up to 4 Inches.

Tread Gum	7 o	$0.31
Cement	¼ pt	.06
Labor	30 m	.25
Set up	15	.12
Total Cost		$0.74

INSERT FLAP.

Use Floating Flap.

Flap		$0.80
Cement	¼ pt	.06
Cementing	10 m	.08
Inserting	30 m	.25
Total Cost		$1.19

STAPLES.

Staples	175 ½ lb.	$0.50
Bead Cover	14 o	1.12
Cutting	45 m	.37
Cementing	15	.12
Cement	¼ pt	.04
Set up	40 m	.37
Total Cost One		$2.52
Total Cost 2 Sides		5.04

PALMER CORD TIRES.

Palmer cord tires are cut down and built up in the same manner as a fabric tire, with either common fabric or cord fabric.

When using fabric, two plies of cords are cut out for one ply of fabric used.

When using cord fabric, single step as usual, for one ply.

Twice as many plies are cut out on sectional work as on a fabric tire.

Cord fabric is one-half the weight of regular fabric, with higher cost per pound.

Twice the labor is required on Palmer tires.

PALMER SECTION COSTS.

With Fabric as used in Fabric Tires.

	3-inch		3½-inch		4-inch		4¼-inch		5-inch	
Cutting	75m..	$0.62	75..	$0.62	75..	$0.62	90..	$0.75	90..	$0.75
Buffing	10m..	.08	10..	.08	10..	.08	15..	.12	15..	.12
Cementing .	10m..	.08	10..	.08	10..	.08	10..	.08	10..	.08
Cement	pt....	.23	pt..	.23	pt..	.23	pt..	.23	pt..	.23
Building ...	30m..	.25	30..	.25	30..	.25	35..	.29	40..	.33
Cushion	1¼o..	.06	1½.	.08	1½.	.08	2...	.11	2½	.13
Fabric	8o....	.41	9...	.47	10..	.55	15..	.78	19..	.99
Bareback ..	2o....	.11	2...	.11	2...	.11	2½.	.13	3...	.16
Sidewall ...	2o....	.09	2½.	.11	2½.	.11	3...	.14	3½.	.16
Tread Gum	2½o..	.12	2½.	.12	2½.	.12	3...	.14	4...	.18
Set up.....	15m..	.12	15..	.12	15..	.12	15..	.12	15..	.12
Total Cost ..		$2.17		$2.27		$2.35		$2.89		$3.25
Cost per additional inch with Fabric		.21		.23		.25		.26		.28

PALMER CORD TIRES.

Repaired with Cord Fabric Special.

	3-in.	3½-in.	4-in.	4½-in.	5-in.	5½-in.	6-in.
Cost per 8-in. Section	$2.73	$2.93	$3.01	$3.70	$4.27	$5.35	$6.50
Additional Inch	.25	.26	.28	.31	.46	.48	.52

RECAPITULATION ON REPAIR COSTS.

Material and Labor Only. Over-head Expense still to be added.

RETREADS (Fabric).

Built up with Gum or Camel Back.

Size	Cost of Material and Labor without Breaker	Cost if Breaker is used
30 x 3	$4.25	$ 4.61
30 x 3½	4.61	5.04
32 x 3½	5.13	5.60
34 x 4	6.21	6.79
35 x 4½	7.71	8.40
36 x 4½	7.92	8.69
37 x 5	9.22	10.02

RETREADS (Fabric).

Built up with Semi-Cured Ribbed or N. S. Band.

Size	Cost of Material and Labor without Breaker	Cost if Breaker is Used
32 x 3½	$ 7.12	Breaker is Included and Built in the Band
32 x 4	7.95	
34 x 4	8.33	
36 x 4½	9.96	
37 x 5	11.16	

RETREADS (Cord).

Built up with Semi-Cured Ribber or N. S. Band.

Size	Cost of Material and Labor with Breaker
32 x 3½	$ 7.93
32 x 4	8.56
34 x 4	8.97
36 x 4½	10.50
37 x 5	11.85

COMPLETE LAYBACK SECTION.

Size	Cost of Material and Labor 8-inch Section	Cost per Additional Inch
3 inches	$1.78	$0.16
3½ inches	1.97	.18
4 inches	2.05	.20
4½ inches	2.46	.21
5 inches	2.82	.23

INSIDE SECTION.

Size	Cost of Material and Labor 8-inch Section	Cost per Additional Inch
3 inches	$1.32	$0.11
3½ inches	1.36	.13
4 inches	1.43	.13
4½ inches	1.78	.16
5 inches	2.07	.16

SIDE SECTION (Layback).

Size	Cost of Material and Labor 8-inch Section	Cost per Additional Inch
3 inches	$1.56	$0.16
3½ inches	1.64	.16
4 inches	1.68	.16
4½ inches	2.06	.20
5 inches	2.32	.20

TREAD SECTION.

Size	Cost of Material and Labor 8-inch Section	Cost per Additional Inch
3 inches	$1.09	$0.10
3½ inches	1.23	.10
4 inches	1.26	.10
4½ inches	1.34	.10
5 inches	1.43	.10

RELINER (Cemented in).

Size	Cost of Material and Labor 8-inch Section	Cost per Additional Inch
30 x 3 inches	$2.74	$....
32 x 3½ inches	2.93	....
34 x 4 inches	3.33	....
35 x 4½ inches	3.82	....
36 x 4½ inches	3.82	....
37 x 5 inches	4.06	....

TREAD PATCHES AND REIN.

Kind	Cost of Material and Labor to 4 Inches
Tread Patch Only	$0.68
Tread Patch and Small Reinforcement	.81
Tread Patch and Large Reinforcement	1.02
Small Reinforcement	.37
Large Reinforcement	.63

TUBES.

Kind	Cost of Material and Labor
Small Hole	$0.08
Large Hole	.09 1/3
X Large Hole	.13
Pad	.27
Valve	.49½
Splice	.44

Above cost on tube work includes the pro-rated time of taking down and setting up tubes on rim and changes.

3-INCH CORD SECTION.

Sizes	Cost of Material and Labor
3½ to 5 inches	$1.50

3-INCH OUTER CORD SECTION.

Sizes	Cost of Material and Labor
3½ to 5 inches	$2.34

3-INCH INNER AND OUTER CORD SECTION.

Sizes	Cost of Material and Labor
3½ to 5 inches	$2.53

CORD TREAD SECTION.

Size	Cost of Material and Labor 8-inch Section	Cost per Additional Inch
3½ inches	$1.17	$0.10
4 inches	1.23	.10
4½ inches	1.28	.12
5 inches	1.30	.12

8-INCH SEPARATION.

Size	Cost of Material and Labor 8-inch Section	
3½ to 5 inches	$1.23	.....

TREAD PATCH TO 4-INCH.

Size	Cost of Material and Labor 8-inch Section	
3½ to 5 inches	$0.74	.....

INSERT FLAP.

Size	Cost of Material and Labor 8-inch Section	
Any Size	$1.19	.....

STAPLES.

Size	Cost of Material and Labor 8-inch Section	
One Side	$2.52	.....
Two Sides	5.04	.....

Palmer cord tires are cord fabric tires and include the following makes: Goodyear, U. S., Firestone, Miller, Kelly, Springfield, and Racine.

REPAIRED WITH FABRIC.

Size	Cost of Material and Labor 8-inch Section	Cost per Additional Inch
3 inches	$2.17	$0.16
3½ inches	2.27	.18
4 inches	2.35	.20
4½ inches	2.89	.21
5 inches	3.25	.23
6 inches	6.00	.....

REPAIRED WITH CORD FABRIC.

Size	Cost of Material and Labor 8-inch Section	Cost per Additional Inch
3 inches	$2.73	$0.25
3½ inches	2.93	.26
4 inches	3.01	.28
4½ inches	3.70	.31
5 inches	4.25	.46
6 inches	6.50	.52

CHAPTER XV.

BUSINESS METHODS.

To the repairman venturing into business for himself, a few words should be said, regarding the way the business should be conducted to build up an established business that will insure steady work and customers. Aim to get a good location of easy access and with drive-in means, if possible, for winter or cold weather changes, and also so that the self-conscious auto owner can drive up to your place of business before his friends, as he would to any other store.

Put in a supply of the necessary tire accessories, only of good quality, and do not be afraid to display them. One good tire should be specialized in and when the customer requests quality, sell it to him. Should he not feel like paying for the quality article, sell him what he wants, but tell him candidly what might happen from inferior tires or supplies, as every car owner has friends with whom his influencce and statements bear results to a great degree. In this way you are at the start establishing yourself in the eyes of your trade, as a person whose work can be depended on.

The automobile is in the owner's mind when driving it and the appearance and cost of running per mile as the most essential things that interest him. Therefore, every repair sent out of the shop should be done in a most workman-like manner, of neat appearance, and put together to stand service. There is no excuse for bungly work or using different colored gums that do not match the color of the tire. Remember that cheap repairs and skimping of fabric, gum, etc., with poor work, never made a large success of any tire repair shop. Put in the best of material, employ the best of workmen, capable of doing a volume of work, and charge accordingly. The customer will pay for it gladly when he finds that the work holds and delivers more mileage than he would get by paying less for it, and at the same time, he depends on your guarantee to make good in every case where you are at fault. He will do a better class of advertising for you and raise you in the esteem of the trade, which cheap work can never do.

The repair work in most cases should be handled on a strictly cash basis, unless the customer is doing business with you every day

and is capable of meeting his bills. There is no reason in opening a book account for small items like fifty cents or slightly more with customers that own individual cars. They are able to pay cash and if you do the work you can demand the money at time of delivery. Hang up a notice to this effect in your shop where everyone can see it. Tire repairs are like gasoline to the car owner, in many cases. He does not feel inclined to be bothered about it after it is burnt up, and you will be out of business in a short time on the small accounts alone, if not careful.

Your shop should be kept in a neat appearing condition at all times, as the customer will draw his own conclusions as to your business ability and the ultimate outcome of your business from the appearance of the shop when he walks into it. If possible deal with him through an office partitioned off from the shop and you will get better results, as a knowledge of your methods and size of your equipment often lowers you in his estimation. Show him nothing but the finished article and give him reasonable service and he will come again.

The term service is of greater importance since the automobile has come into such prominent use, due to the fact that the owner of a car has a feeling that he should be waited on and shown courtesy. This should be done for a successful business venture; however, the term service, should never be construed to mean free service or doing work for nothing. No repairman can afford to give away his money, which is the same as time, unless it nets him a fair return. Labor is like the tires you sell and should be paid for. Such work as changing tires for a customer, when no work or sale is made, should be charged for, the work, however, being done in a quick way, with courtesy to please the owner. He will pay for it. Some shops have service cars, which make a practice of picking up repair work and giving general service to regular customers, but the writer believes that any trips for the individual owner should be charged for and collected on the ground, providing he has been taken care of satisfactorily. Do all the work pleasantly and have your men do likewise. Never keep a grouchy workman around your shop, as he will drive away trade for you. The owner will get the spirit in which you work and form his own idea.

Should you close a certain hour, post a notice so that the customer will know what hours he can expect service, and in this way he will not feel that he is being slighted. If you give service at all hours, be prepared to do so and have your changing tools in the shop or car

ready to go to work and finish up the job without being short some item that requires a trip into the shop or out on the road before you can get the car moving.

Should the customer bring a repair or new tire back to you for adjustment, make the adjustment quickly, without haggling and in a manner that will convince him that you are pleased that he is giving you a chance to rectify the error. This will get you more business than anything you can do. Should the customer be in error, or asking something out of reason, or the fault does not lie with your work or shop, do not hesitate to tell him so in an agreeable manner, for if you do not, it will lower you in his estimation, providing he is trying to put something over on you, and you will give him the impression that you do not know your business. After you have explained to him where the fault lies, you can still do the work for him, either at a charge sufficient to cover the cost or free if you desire. Remember that a guarantee on a repair job is the same as on a new tire, and that abuse, such as bruises, run-flat, or chain-use, will affect a repair in the same manner as it would a new tire and the repair shop cannot be expected to do work over, free, which is the cause of abuse, knowingly or unknowingly. If the owner has had several thousand miles out of a repair he must expect to pay for that mileage and should gladly accept some charge for it.

Air should be provided for free use to your trade at all times, for the filling of their tires, and the pressure should be kept up night and day, providing it is on the street for general use. In some cases a man is usually provided to fill customer's tires, who can with proper attention and courtesy, pick up and secure many tires for repair that require same, by calling the owner's attention to same when he is filling the tires. When using additional cores, caps, etc., a charge should be made, as you will be surprised at the loss derived from this source in a year's time.

A certain amount of advertising and publicity should be given your shop at regular intervals. In other words, your shop has to be brought to the owner's attention at the moment when he needs tires, repairs or service. This can be done in many ways and a certain amount should be set aside from the profits for publicity in a large town, in order for the business to grow. One of the best methods of advertising the writer has seen and which was not very expensive, when compared with results obtained, was to drop business cards in the driver's seat of every car within a cetain area, every day during the busy sea-

son. On the back of the card was a general outline of the business and service. The ultimate outcome, was that a large per centage of the cars in the city parked in this area at different times and the name of the shop and location was brought to their direct attention, with the result that the shop was overloaded with work and calls, just from the card use. Many other ideas will present themselves to the repairman, some of which should be used, after careful study of final results; care, however, should be taken to use only such advertising as you can afford at the time. You can increase your advertising as your business grows larger.

In all cases, the owner of the tire repair shop should take advantage of all cash discounts on payments of bills by a certain date and the prompt payment of bills should be one of the essential items on the mind of the owner at all times. The payment of thirty-day bills or dating accounts will never be overlooked by the repairman who is looking forward to a successful continuance of business.

Another item that requires the attention of the shop owner at all times is the over-head expense, that is expense outside of the cost of material and help. Do not get into quarters where the rent is double what you can get along with, and while the percentage of profit in the tire repair business is considerably greater than in many others, you must remember that you are dealing in smaller amounts and must have a larger volume of work to tide over the expense for the whole year. Your busy season is usually short, during the driving months, and it is in these months that you must make the profits for the year. Do not stay in the shop and wait for local work to come in, but during these months go after shipments in outside territory, where there are no shops or where poor work is being done. Get acquainted with what your competitor is doing and if his work is not up to the minute, and the customers are dissatisfied, start advertising in that vicinity.

We have endeavored in this book to give the expert tire repair man and novice a complete outline and detailed explanation of the entire trade, which if followed will be found useful in many ways.